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[OFFICIAL NOTICE.]

Wrinkle Department, Western Gas Association.

WESTERN GAS ASSOCIATION,
OFFICE OF EDITOR, WRINKLE DEPARTMENT,
MILWAUKEE, WIS., Oct. 25, 1905.

To the Members of the Western Gas Association: The next meeting of the Western Gas Association will in all probability be the last one, owing to the proposed merging of the three leading gas associations. Therefore, every effort should be made to make it a rousing success in all respects, and it falls to my lot as Editor of the Wrinkle Department to again appeal to you for this department. I earnestly request those who have made promises of contributions to remember such as soon as possible, and I fully expect to hear from quite a number who have not made any promises, but who I know are in possession of something that would prove of value to the Wrinkle Department.

Yours very truly, B. MCADAM, Editor.

[NOTICE.]

Wrinkle Department, Ohio Gas Light Association.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF THE WRINKLE DEPT.,
719 CITIZENS BUILDING,
CLEVELAND, O., June 13, 1905.

The Wrinkle Department of the Ohio Gas Light Association is now ready to receive contributions for the 1906 collection, and a sketch or description of all devices, formulæ and methods of accomplishing objects pertaining to the gas business, is respectfully solicited.

Please send a written explanation, accompanied by any sketch, photograph or drawing, to the above address, or a description alone will suffice.

Hoping to receive prompt compliance,

Yours very truly, W. E. STEINWEDELL, Editor.

BRIEFLY TOLD.

NOTES.—

AT a meeting of the Warren (Mass.) Selectmen, held about a fortnight ago, it was decided without dissent to grant the Worcester County Gas Company the right to supply gas to the residents. The prior vote, at a town meeting held October 23d, also favored the scheme.

AT a meeting of the City Council, of Quincy, Mass., held November 13th, a public hearing was had over the petition of Levi H. Turner and associates, requesting that the authorities, in one way or another, establish and operate on public account a gas and electric lighting plant. From the nature of the testimony taken, and the comment made on it later on, it does not seem that the plan will ultimately find or secure official indorsement.

MR. J. M. BERKLEY, after a service of 2 years successfully spent in the employment of the Union Gas and Electric Company, of Blooming-

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ton, Ills., will spend the winter with his family in Southern California. The vacation comes to him through the fact that the plant and franchises of the Union Company were purchased recently by new owners. When his vacation is ended, which will be some time next spring, he will return to activity in the gas business.

THE Westborough Gas and Electric Company, of Westboro, Mass., is in the market for the following lots of high pressure pipe, to be delivered on or before March 15th, 1906: 32,000 feet 2-inch, and 11,000 feet of 4-inch, with the necessary couplings, valves, meters and the like for a gas service. Bids are to be made to Mr. Thos. F. Peabody, President, Needham (Mass.) Gas Company.

AT the annual meeting of the shareholders in the United Gas, Electric Light and Fuel Company, of Sandy Hill, N.Y., the following officers were elected: Directors, J. L. Wentz, George L. Wentz, C. P. Wentz and H. M. Collin; President, C. P. Wentz; Vice-President, George L. Wentz; Treasurer, John L. Wentz; Secretary, H. M. Collin. Mr. William L. Clarke, who has filled the position of General Manager since 1901, presented his annual report and also his resignation, the same to take effect June 1st, 1906. Mr. Clarke further stated that if plans which he is now considering are brought to maturity, he might ask from the Company an earlier release. The Directors expressed great satisfaction with the report—particularly as to its financial statement—and warmly praised Mr. Clarke for the efficient way he had conducted the affairs of the Company. The resignation was then accepted and Mr. H. M. Collin, who has been the Company's popular cashier for 5 years, was elected Superintendent. Mr. Collin will assume the duties of his new position upon his return from a vacation which he is now taking.

THE St. Augustine (Fla.) Gas and Electric Light Company is making sensible additions to its main system.

THE new holder for the Hillsdale City Gas Company, of Hillsdale, Mich., which is being constructed by the Stacey Manufacturing Company, will be in working order next week.

NORTH ADAMS, MASS., will not have anything to do with the operation of gas and electric lighting plants on municipal account.

An English Awakening.

Electricity notes that an important movement has been set on foot in Great Britain with a view to awakening among the masses of the English people an interest in, and belief in, the powers of science, such as have been long noticeable to a far greater extent among the people of the United States and of some European countries. The scientific spirit, it is complained, though so essential to all true progress, is still rare, and is too often lacking in an almost incredible degree in some of those who are responsible for the conduct of many of the British national activities. The movement to which we have referred, and whose object it is to remedy the evil and bring home to all classes the necessity of applying scientific treatment to affairs of all kinds, has now developed into what has been termed the British Science Guild. In this guild there being brought together a very large number of leading men interested in all different departments of science, including Lord Kelvin, Sir William Crookes, Prof. George Darwin, Sir Archibald Goikie, Sir Norman Lockyer, Professors Ayrton Perry, S. P. Thompson, and so on; but it is by no means confined to scientists, for it includes representative leaders of all the great industrial and manufacturing organizations of that country, educational authorities, and indeed all branches of human endeavor whereon a beneficial effect would be felt from the wider applications of scientific method. The inaugural meeting of the guild was held in London under the presidency of the Lord Mayor on October 30, and many interesting speeches were delivered which excited the enthusiasm of a goodly gathering of sympathizers and gave the movement a good send off. To these speeches we need make no more than the briefest reference. Their purport was: If the English as a manufacturing nation wish to stand out prominently in the competitive struggle between the nations of the world, there must be an end to the apathetic treatment of scientific men and methods by Government departments that the niggardliness of the Government in making grants to universities and other institutes where scientific education is imparted must end; that the "common people," if we may use a convenient though sometimes objectionable term, must be taught to think; and that the aptitude for scientific application shall be secured to the industrial worker in the factory as well as to the employer and the manager.

[ABSTRACT.]

PROCEEDINGS, THIRTY-THIRD ANNUAL MEETING, AMERICAN GAS LIGHT ASSOCIATION.

HELD IN THE HOTEL PFISTER, MILWAUKEE, WIS., OCTOBER 18-20, 1905.

FIRST DAY—MORNING SESSION.

The convention was called to order by the President, Mr. E. G. Cowdery (St. Louis, Mo.), at 10:20 o'clock, who introduced the Honorable David S. Rose, Mayor of Milwaukee. The Mayor delivered the following

WELCOMING ADDRESS:

Mr. President and Gentlemen of the Association: I am doubly pleased to meet you. First, for the purpose of extending to you the greetings of our people, primarily, and because I want to use you, secondarily. The fair name of Milwaukee has been disgraced before the world, her reputation has been traduced, and I desire to appoint every member of this convention a committee of investigation to inquire and ascertain for himself, in a spirit of fairness and justice, whether the reputation which we have gained justly belongs to us.

Within the past 2 weeks the fourth grand jury was impaneled by one of our courts to investigate conditions in our city and county adjoining, and while the grand jury was sitting the newspapers throughout the length and breadth of this land characterized our city as a city of corruption and graft. I wish to explain to you the conditions that have prevailed, and from the statements I shall make, each of which I stand ready to verify by abundant proof, I rather apprehend you will join with me in the conviction that no other city upon the face of this earth has been more unjustly maligned than has our beautiful city of Milwaukee. Until a few years ago we had in this State what every other State in this Union possessed—two great political organizations, the Republican party and the Democratic party. In recent years the Republican party became divided against itself. One faction was characterized as the stalwart faction, of which Senator Spooner was the recognized head, and the other faction was denominated the halfbreed faction, of which our present Governor, Mr. La Follette, is beyond question the dictator and the official head. I charge that this grand jury was organized, not for the purpose of ferreting out crime, detecting the criminals and presenting them for indictment, but for the purpose of marking certain individuals for the sacrifice, and then ferreting out any old offense that might be foisted upon them, for the purpose of lessening their influence and gaining political advantage to the political faction that inaugurated the scheme.

This is a bold statement to make, but I am driven to make it in defense of that city to which I owe everything. I say that it was not the primary purpose of these intriguers to vindicate the law, but it was their sole purpose and aim to accomplish political results by using the agencies of our courts for their despicable purposes. Two men were selected for the sacrifice. One is Mr. Pfister, who has been prominently identified with the stalwart cause in this city, this county and this State. He was selected because they felt that by his indictment they would accomplish his political downfall and destroy his political influence. The other selected was my humble self, because I, as Mayor of this city, and being prominent in Democratic politics, stood in the path of their ambition, and they thought by traducing me they might gain control of the city administration and distribute the many desirable plums to the cohorts of their organization of minions.

I want to say to you, gentlemen, in defense of Mr. Pfister, and I speak in his defense only in a spirit of absolute and exact justice, that we have no man in the city of Milwaukee who has contributed so much to the growth and development of our city as this same individual. Had he come, redhanded with crime, he won atonement on the 24th day of April, when the greatest banking institution in our city and the largest banking institution west of Chicago was struggling for existence, when the fact became known that one in whom every man had placed implicit trust and confidence had betrayed that trust and had become an embezzler. We, of Milwaukee, remember the run made upon that bank; we remember the fact also that, had it not been for Mr. Pfister, who was the first to head a guarantee list with $600,000, if it had not been for the attitude that he maintained in that terrible crisis, that bank with its $16,000,000 of deposits would have closed its doors, and had that bank closed its doors, every other banking institution in the city of Milwaukee would have followed in its wake. I say whatever he might have done, and by that I do not mean to charge he had done anything he ought not to have done—but whatever he might have done up to

that time ought to have been forgiven by every man, woman and child in the city of Milwaukee, because he was the savior of our business interests; because he was the savior of the manufacturing interests, and of the poor people of our city. (Applause).

About 250 indictments were returned by these grand juries. More than 100 of them were presented on the uncorroborated evidence of confessed bribetakers and bribegivers and perjurers, and one of them, a convicted petty thief, charged and convicted with having stolen discarded furniture out of the court house in this city when he was a registrar of deeds. That was a sample of the class of evidence on which these indictments were founded. Mr. Pfister was charged with the larceny of $11,000, when every man who knows him is cognizant of the fact that he gives more than that amount every year in unostentatious charity. No sooner was the charge published in the newspapers, and it became known, than the officers of the corporation which it was charged he had robbed, rushed into the newspaper offices with the declaration that they had not lost one cent in their transactions with Mr. Pfister. I am here to say that he has been tried at the bar of public opinion and acquitted by the unanimous verdict of the reputable people of the city of Milwaukee. A more outrageous, contemptible, vicious attempt to accomplish political results by disreputable means was never attempted to be carried out in any city upon this continent.

And now I want to tell you what Milwaukee is. It is a city of 325,000 inhabitants—a cosmopolitan population, because in our citizenship we have representatives of every civilized nation upon the face of this earth, all working together in perfect harmony, seeking to accomplish the greatest good to the greatest number. Milwaukee is a great manufacturing city; our manufactured products exceeded in value $260,000,000 a year. Our manufacturing industries give employment to 85,000 operatives. A great commercial city, our wholesale and jobbing trade amounts to $318,000,000. Our lake tonnage is greater than that of any other large city upon the chain of great lakes, including the magnificent city of Chicago. Milwaukee is a city of homes. Go out if you will into the residence districts. There you will find the mansions of the rich, and by them you will find the humble cottages of the poor laboring men and the more pretentious residences of the artisan and skilled mechanic. There you will find flowers, foliage and verdure. You will find taste—artistic taste; you will find an air of prosperity and happiness and peace pervading every section of Milwaukee. We have no tenement house districts; no breeding places of crime and disease. Our people are a happy, contented, prosperous people, speaking literally in every sense of the term.

In our public institutions we undertake to keep abreast of the times. We understand that it is the spirit of competition, the friction of competition, that brightens in individual effort, and it is that same spirit of competition that leads to the growth, development and upbuilding of our American cities; and Milwaukee is not behind. We point with commendable pride to our splendid city hall, erected only a few years since at an expense of upwards of $1,000,000, and it is one of the most commodious and delightful office buildings in the whole country; to our splendid library and museum building, which stands as a monument to the enterprise, intelligence and public-spiritedness of our people, built as it was out of their openhanded charity, without contribution from the State. We point to our magnificent common school system, forming as it does a part of the educational system of Wisconsin, which has operated to place this State in the foremost rank in the sisterhood of States from an educational standpoint; to our park system, young in years but mature in beauty and attractiveness; to our numerous places of amusement; to our well-paved streets and the cleanliness of our streets and alleys and public places, and to the good order that prevails everywhere.

In the administration of government we believe in the old principle that that government is best which governs least. We believe that the best way to govern the average American citizen is to put him on honor and permit him to govern himself. (Applause.) We recognize the fact that there are evils which will not down, that there are evils which have existed since the birth of man, and we do not feel great enough or big enough or strong enough to eradicate those evils which civilization and Christianity have been unable to eradicate in 2,000 years. We have been honest enough to recognize the existence of these evils, and have been animated by an honest desire to minimize them by strict regulation. When you go upon our streets I ask you to observe the fact that you will see fewer intoxicated men than upon the streets of any other large city you have ever visited. I apprehend, notwithstanding the fact that we have these great manufacturing industries whose splendid product has operated to make Milwaukee famous, so they say, and you gentlemen who may not have had opportunities to taste the beverage which we call the nectar of the gods are now up against it. We feed it to our babes. I have been criticized by some good people because I made that remark once before. We keep it in our homes. We believe it is the great medium, the neutralizer, which prevents intoxication rather than increases it. If you want to see the result of its use, observe the beautiful women of Milwaukee, as you see them on the streets, and the strong, sturdy, patriotic, enterprising, pushing men of Milwaukee, who are ready for any emergency and ready to meet any crisis.

We have a magnificent police department. I do not know whether you gentlemen will be at all interested in having me explain to you the operations of our police department. I do not enjoy a personal acquaintance with many of you, but I learned a long while ago that all men are built out of the same old mud that God put in the earth. Our policemen are absolutely harmless upon occasions of this character. (Laughter.) I say to you that it would be a physical impossibility for you to break into any of our police stations; they are absolutely secure. If anything should befall any of you gentlemen, if it be in the daytime, remember that my office hours are from 8 in the morning until 5 in the afternoon, and also that I have a telephone in my house at night. I trust that the purposes for which you are assembled here will be abundantly served. I trust when you have an opportunity to investigate conditions as they exist in Milwaukee, that you will be honestly convinced that, instead of Milwaukee being a city of graft, there is less of it here and fewer evidences of it than in any other large city upon this continent. After 4 years of probing and investigation, conceding that all men indicted were guilty, the total amount involved in grafting was less than $13,000. That would not be a good mouthful in New York, and if I am told the truth, it would not be a taste in Philadelphia. (Laughter and applause.)

You gentlemen have shown your confidence in Milwaukee, and I want to commend your most excellent judgment, by selecting for your President my old friend, our old fellow citizen—and I wish to God he was with us yet—"Ed." G. Cowdery. (Applause.) Between your sessions, visit our places of amusement. Go out into the outskirts of the city and see where our laboring people live. Note the air of contentment and prosperity that pervades everywhere. Go into the more private residence portions of our city and see the beautiful mansions that stand as monuments to the artistic taste and skill of our architects and builders. Enjoy yourselves as best you can for—using the expression of Mark Twain, when we are dead we are a long time dead—and carry back with you to your homes pleasant recollections of the convention of the Association which was held in Milwaukee. I thank you for your attention. (Applause.)

Mr. Glasgow's Response.

The President called upon Mr. Arthur G. Glasgow, of London, England, to say a few words in reply to the address of welcome, which Mr. Glasgow thus spoke:

Mr. Mayor, Mr. President and Gentlemen: It is my happy privilege to tell you, Mr. Perennial Mayor, how pleased we are to meet in this beautiful city of Milwaukee. From my own experience I know it is a pleasure to visit Milwaukee, singly and alone, and not in an official way. How much greater pleasure, then, must it be for hundreds of old friends to gather together and to be welcomed in such stirring and at times impassioned periods as we have heard from the eloquent Mayor. I think I may assure you, sir, that if we were a grand jury and you represented an object of investigation, there would be no question of your triumphant acquittal.

I keep in store, as usually one does, a few words which may be suitable in response to the ordinary cool and perfunctory words of greeting, but I admit that I am somewhat nonplussed when I consider the intensely interesting scope of the remarks of his Honor, the Mayor. As far as any civic criticism of Milwaukee is concerned, I think one might very well say, in the words of the great native of Massachusetts, "Here stands Milwaukee. She speaks for herself."

If this is an example of what may be arrived at by corruption and graft, I want a little of it around me where I live. (Applause.) When I spoke to a friend of mine—I have a good many friends in Philadelphia, although I do not care to say it too publicly—he said to me, "What sort of a Mayor is this; is he a reform Mayor?" I answered, "Well, I don't know about that; but he is a Democrat, and usually a Democrat is all right. If he is a reform Mayor, I hope he spells reform with a small 'r,' and does not put it in inverted commas."

When you were speaking, sir, about civic questions, it brought to my mind a short phrase in a speech of Mr. Joseph Chamberlain, who

is unquestionably the greatest civic demonstrator in England, in my recollection. It occurred in a speech when he was accepting the freedom of the city of Glasgow. He is a Birmingham man himself, and both Glasgow and Birmingham stand very high in urban administration, as everyone knows. The text of his speech was the great danger in town administration is that we are induced to pay a workingman too much and our officers too little. That was a bold thing for a man who depends on votes for the continuance of his public career to say; but it is worth thinking over.

I think, sir, that I need only say again that we are very happy to be here, and that we appreciate intensely your address and its novel and thrilling character. We felt a little thrill of anxiety when you referred to the splendid character of the police service, but now that you have squared us on that point there is nothing that can interfere with our utmost enjoyment of the hospitality of your beautiful city. We thank you. (Applause.)

President Cowdery—The first business of this meeting I believe, is the reading of the minutes of the previous meeting.

On motion of Mr. E. G. Pratt, the reading of the minutes of the last meeting was dispensed with.

(To be Continued.)

Some Thoughts on Condensation.

[A paper read by Mr. James S. McIlhenny, of Washington, D. C., at the Thirty-third Annual Meeting, American Gas Light Association, Milwaukee, Wis., Oct. 18–20, 1905.]

In treating the subject of gas condensation I prefer to consider it as a whole; that is, the treatment to which gas should be subjected from the point of generation to the point of consumption, excepting only the chemical reactions for removal of sulphur compounds commonly called purification.

This subject is of great interest, and I will emphasize my belief that, apart from the necessity of at all times being able to furnish the consumer with gas, no other feature of the gas business is of more importance than a thorough understanding and application of it, and nothing else will as quickly bring credit to the management of a company. Much has been written upon the subject and many valuable laboratory experiments have been made, but unfortunately this work has not been comprehensive, usually being directed to some special feature, so that a thorough understanding is lacking and there is little tendency to change from old methods.

Other features of the business have been given great attention and developed in minute detail, but condensation seems to have been neglected, or else in practice is treated in such a perfunctory way as to make the results obtained of little value, and at times even worse than useless.

Comparisons of results at different works are often misleading, as it is impossible in all cases to obtain perfect conditions for such observations owing to the varying conditions under which gas is manufactured, such as difference in candle power, weather, quality of coal or oil used, and the general construction of the manufacturing plant. This difficulty is more apparent in condensation than any other feature of gas manufacture, and it affords some excuse for the evident lack of exact information upon this important subject.

While these varying conditions exist there is no reason why gas should not be subjected to such treatment at the works as would insure its delivery throughout the distributing system without serious change of character or causing any trouble from deposits. Changes in temperature would affect gas after leaving the holder, but we have in hand enough control of the situation within the works to approximate such treatment of the gas as it is likely to meet throughout its course of distribution; and it is my belief that cause for complaint, not of a mechanical nature, can be greatly lessened by care and attention in the manufacturing department.

The two great purposes for which condensation should be studied are: First, removal of tar and heavy hydrocarbon oils which are certain to be precipitated from the gas at lower temperatures than that of generation; second, treatment of gas which will insure its delivery throughout the distributing system without serious change. While both of these are important from a dollar-and-cents' point of view, they have separate bearings upon the two great divisions of the gas business; the first affecting and influencing good and economical manufacturing results, the second affecting the cost of distribution and to a large extent influencing the intimate relations between the consumer and the company. Good results obtained in the first instance would secure credit to those charged with gas manufacture, and such results in the second instance would give pleasure and comfort to the consumer and would increase the friendly relations between them, and thus indirectly reflect credit upon the manufacturing management. No matter how careful or how thorough the distribution and complaint department of a company is organized and managed, it is utterly powerless to cope with the cause of complaints or to obviate the friction with consumers which is certain to arise; and their work yields but indifferent results, unless the management of the manufacturing department has performed its work well.

As an outgrowth of practice, certain forms of condensing apparatus have been developed and from custom have been accepted as standards. Text books variously place the proportion of cooling surface to rated capacity: but certain rules have been accepted governing this relative proportion as being the standards in construction work, no effort being made to adjust and proportion the apparatus to suit the conditions of gas manufacture. The fault of this is apparent when we consider the varying conditions of gas manufacture.

Coal gas and water gas, while possessing some similarity, differ in their physical and chemical nature, and gas generated under different conditions does not have the same formation; as, for instance, coal gas generated and subjected to high temperatures would contain more naphthaline, owing to the benzole being broken up into its constituents, while that generated at a moderate temperature would contain more benzole, and the tars would be different in character and would require different treatment in condensation. Yet we find the same apparatus, both as to type and proportion, designed for all these conditions. This may to some extent offer an explanation why naphthaline troubles occur in one works and not in another; in one case the apparatus evidently not being designed to suit the conditions and in the other case proving satisfactory.

In the location of apparatus it is often the case that convenience controls the selection of the site, no thought being given to the relative positions of the other apparatus or a design to accomplish a specific purpose. To get a better idea of the subject it would be well to take it up at the point of generation and follow it by stages throughout the system.

In coal gas manufacture the greater portion of tar is deposited early, due to the rapid reduction of temperature in passing through the standpipes and by contact with water in the hydraulic main. In the early days some effort was made to control this sudden deposit, but such efforts met with poor success, and it has now come to be considered as part of the generating system and to be studied from that point of view. While I pass over this part of condensation briefly, I do not by any means regard it as unimportant or having been fully developed; but until there is a better understanding of the proportion of apparatus to work required, but little improvement is likely to be found.

Primary Condensation.—Two forms of apparatus are in use for this purpose, the older and more popular being the erection along the walls of the retort house, or at other convenient points, of a long line of main connecting the hydraulic main with the exhauster, the other being of the multitubular pattern. Some difference of opinion exists as to the value of this primary condensation, and as reports of results obtained are so conflicting the question still remains to be settled.

At the West Station works of the Washington Gas Light Company, connecting the hydraulic main with the exhauster, there is a line of pipe about 1,000 feet long, part of which is exposed and part underground. During very cold weather the temperature of the gas in this main is reduced oftentimes as low as 85° at the inlet of the exhauster, and at such times there is some difficulty in maintaining good candle power. Contrary to expectation there is little deposit of tar in this main. Some water is found, but the tar continues on, even at low temperatures, until it passes through the exhauster into the pressure side, the deposit there being very rapid. This would seem to prove that an absorption of illuminants by tar took place after the gas had been sufficiently cooled, but as the gas was under a slight vacuum and no frictional surface interposed, the deposit did not take place until the gas reached the exhauster or was put under pressure. Doubtless the exhauster assisted in the deposit, as a considerable quantity of tar was noticed at that point.

Scrubbing.—There is some confusion of ideas as to what class of apparatus properly comes under this head. In water gas plants all apparatuses designed for the removal of tarry matter by frictional contact, either with or without the aid of water, are usually termed scrubbers, while in coal gas works the apparatuses classed under this head are generally understood as being for the purpose of removing ammonia, that which removes tar being classed as tar extractors. For convenience I prefer to consider all apparatus having for its object the

removal of tarry matter by frictional contact with some solid body, either with or without the aid of water, as scrubbers.

Many types of apparatus have been designed for this purpose, such as vessels fitted with perforated plates, or filled with slats of wood, coke, wooden cubes or shavings, the object being the removal of tar and entrained moisture by direct frictional contact with some solid body; but occasionally we meet with some form of apparatus designed for the removal of tar, ammonia, sulphuretted hydrogen, carbonic acid and enrichment of the gas, with the result that no result is apt to be satisfactory.

Of those most in use the shaving scrubbers and perforated plate types seem to give best satisfaction. No matter what form or type is selected it is certainly necessary to use something of this character for removing the light tars, as condensation alone will not do it even though very low temperatures be reached.

Any objection to the use of scrubbers is probably due to too much being expected of them. Usually the whole process of tar removal is attempted in one piece of apparatus, and to accomplish this it is designed as a general catch-all, independent of the condition of the gas at that point. There is also a wide variety of opinion as to the point at which they should be located; one man saying that he preferred to locate it at the inlet of his cooling apparatus, as it would reduce the candle power if located on the other end; another that he preferred to locate it at the outlet of his cooling apparatus, because it would stop up if located at the inlet; and a third upon being questioned as to why the apparatus was located at a certain point, said that that was the easiest place to put it. It would be interesting to know the exact conditions surrounding such cases.

Any loss of candle power due to the actual removal of tars and contained illuminants in passing through a scrubbing apparatus cannot be directly chargeable to it, but it is a serious question if harm is not often done in the treatment of gas to permit of this sudden removal of tars in a single apparatus, so that in order to reach a fair conclusion it would be necessary to consider the treatment which the gas has undergone previous to reaching it.

Should the apparatus be placed immediately following the exhauster, it would have to deal only with the tars and condensed moisture that would be precipitated at high temperatures. It is then not likely that any serious harm could be done at that point; but on the other hand the work of removal of tars would only be partially completed. Those that would be precipitated below this temperature down to the final point of cooling would pass forward only to be deposited further along in the system, and as no frictional surface is interposed they would continue with the gas at such temperatures as would cause absorption of illuminants by them. The loss of candle power in this case, while not being apparent at the apparatus, is indirectly due to it. On the other hand, where this apparatus is located at the outlet of the condensers the loss is also due to the long continued contact of the gas with tar at temperatures that would permit reabsorption of illuminants which would finally be removed with it.

Condensing or Cooling.—For this purpose two forms of apparatus are in use, the older being the air condenser consisting of a continuous coil of pipe exposed to the atmosphere. This type of apparatus possesses the advantage of a reduction in temperature and at the same time some frictional scrubbing due to the contact of gas with the surface of the pipes, thus removing such tars as may be condensed at each lessening temperature; but the disadvantages of lack of control, ground space occupied and large first cost have gradually led to its abandonment and the substitution of the more modern type of multitubular condenser. The multitubular condenser possesses the advantages of better control, occupies little space and is of low first cost, but it has the great disadvantages of little frictional contact during condensation and extreme rapidity of reduction in temperature. It is not reasonable to suppose that gas can be reduced in temperature so suddenly without some harm resulting, and the swift travel of gas through the apparatus does not permit the matter condensed out to be deposited in the apparatus, the result being that it is carried forward to some inconvenient place in the system, causing trouble there.

Ammonia Scrubbing.—All apparatuses designed for this purpose have the general object of removing ammonia by bringing gas into intimate contact with water, and it is not likely that any method for removing ammonia other than this will soon be adopted. It only concerns condensation in that it offers another point for the gas to become thoroughly saturated with aqueous vapor, and as this apparatus is not usually followed by any frictional scrubbing, the temperature there would control the amount of moisture carried forward in the gas from that point.

From this brief description of condensing apparatus now in general use it will be seen that each possesses some merit but none is perfect. Some gas works have only a portion of the apparatus here described; few are so fortunate as to have it all.

The usual practice is to reduce the temperature to a desired point, such scrubbing being done as convenience will permit, and then the gas continues its course throughout the subsequent portion of the system without further attention. While the different conditions under which gas is manufactured would prevent the making of fixed rules in regard to the details of condensation, there is no reason why a general scheme cannot be adopted which would embrace the good features of apparatus now in use and largely eliminate their defects. To successfully accomplish this it will be necessary to devise some plan by which the gas can at all times be kept under perfect control both for cooling and frictional scrubbing. This can only be done by dividing condensation into a series of stages, each stage of cooling to be followed immediately by a stage of frictional scrubbing; this process to continue throughout the entire system.

Gas after leaving the hydraulic main of a coal gas works or the seal box of a water gas apparatus is at a temperature of from 120° to 200°, and contains much matter in vapor form which should be removed before the final point of cooling is reached. At each stage of a reduction in temperature a portion of this is changed from vapor to a liquid, this change continuing throughout the process. In the early stages of temperature reduction the condensed matter consists of heavy tars and water and but little illuminants, and at each succeeding stage the condensed matter would differ from that of the preceding. To reduce this temperature by one action and to remove the condensed matter in one mass cannot but be hurtful, or to allow the condensed matter to continue on until precipitated by gravity or by scrubbing at the final point of cooling would allow the tars full opportunity for reabsorption of illuminants.

As the character of gas and condensed matter would vary at each stage it would be neceseary in order to have perfect control to construct such apparatus in series and proportion each stage of both cooling and scrubbing to the work required at that point; as, for instance, in the first stage for the condensing of heavy tars but a small reduction in temperature would be necessary, and for their subsequent removal the frictional contact should be at slow speed and a soft impingement, so that the proportions of this section of apparatus would be a small area for cooling and a large area for scrubbing, a large area causing a slower speed in the scrubber and permitting the use of large perforations in the frictional body. In the following sections of the apparatus these areas would progress inversely with gradually increasing condensing area and gradually decreasing scrubbing area, the result being a gradually decreasing speed in the condenser with increasing condensing area and a gradually increasing speed in the scrubber with decreasing size of perforations. The character of the gas to be treated would determine to some extent the regulation of these proportions, and observations made at the drip-pots would be of great assistance in guiding this adjustment.

The advantages of divisional condensation are: First, perfect control of temperature during each stage of cooling—this feature alone would justify any reasonable attempt in successful attainment; second, the ease of adjustment of scrubbing areas to suit the conditions of gas manufacture and to so proportion them as to fit the needs of the case, no matter what character of gas is under treatment. This value cannot be overestimated, for upon the effects of proper scrubbing depend to a large extent the results obtained. Writers upon the subject of condensation lay stress upon the necessity of the separation of gas and tar before reaching a temperature that would permit the reabsorption of illuminants by tar, the danger point being placed between 90° and 100°, any association below this temperature being accepted as hurtful to the gas.

On the other hand, tars condensed at the early stages contain nothing that there is a possibility of the gas again taking up to its advantage, so that we can plausibly assume that their removal at the end of each stage of cooling is a distinct advantage, and further, by removing them we add to the condensing capacity of the apparatus, because the tars if not removed would coat the condensing surface and so lessen their capacity; third, divisional condensation would maintain the candle power, as the removal of tars at each stage would prevent the possibility of any reabsorption of illuminants, while the slow condensing feature would permit the full value of the illuminants to be held in the gas; fourth, naphthaline troubles in the works could not occur, for by the removal of the condensed matter at each stage of cooling, and by proportioning the speed of scrubbing

and frictional contact to suit the removal at each stage, whatever naphthaline the tars would absorb would be removed in a fluid state, and should this divisional condensation be carried throughout the system it would remove all aqueous vapor held above its temperature tension and so permit no deposit of this sort at inconvenient points.

At first thought it would seem that such a scheme as outlined would be impossible from excessive first cost or cost of attention necessary to operate it; such in reality would not be the case. Of the cooling feature alone no additional cost would be added. To reduce a unit of gas from the temperature of generation to that which it is ultimately intended to reach requires the extraction of a certain number of heat units and a fixed ratio of cooling area. It does not matter whether this area is in one apparatus or in many as long as the proportion of surface contact is maintained. In the scrubbing feature some additional expense would be added and also in connections and details of construction. As to the cost of operation, it would require no additional expense; perhaps some more attention would be necessary, but even in this the apparatus could be so arranged as to reduce it to a minimum. Admitting that there would be no additional expense for installation and attention, it should not be considered as an argument against the adoption of anything of merit. In other features of gas manufacture the limit of extravagance is often reached without regret where mere fractional savings are made; and so in this feature, where the possibilities of improving conditions are so great, we would be justified in large expenditures in the hope alone of improving conditions.

Some years ago, at the West Station works at Washington, a great deal of trouble arose from naphthaline deposits, both in the works and in the distributing system, and at sudden changes in the weather the matter became extremely serious. Owing to the rapid increase in gas consumption all the condensing and scrubbing apparatus had become too small, the main reliance being two multitubular condensers which had been recently added. These condensers were of ample size to reduce the gas to any temperature desired, but as they were not followed by any frictional scrubbing little could be accomplished with them to lessen the trouble. Fortunately an air condenser had been ordered, but owing to press of work had not been erected. Upon taking charge of the works I had this erected as early as possible, the gas being passed through the air condenser, reducing the temperature to about 110°, and then through the multitubulars, reducing it to 60°. Immediately conditions improved, but occasional stoppages continued to occur in the works, and with each change of temperature some trouble would be had in the services. Soon after this an entire new plant of the modern water gas type, with scrubbers and condensers attached, was installed, and a large relief holder was put in service. The gas was then passed through the scrubbers and condensers of the water gas set into the relief holder, and exhausted from the relief holder through the air condenser and multitubular condenser, as was previously done. As the connections throughout the works were of considerable length, they afforded some frictional contact. This arrangement immediately proved more satisfactory, not a naphthaline stoppage having occurred in the works since, nor is there any appearance of it now. Conditions in the street department became so much better that we had come to regard the matter as being solved; however, at extreme changes of temperature occasional naphthaline stoppages continued to occur in exposed services. The erection of a new storage holder assisted in relieving this. This holder was some distance from the manufacturing department, and from the outlet of the station meter to the inlet of the holder was a line of main about 1,500 feet long. This pipe was laid on a grade, allowing the water to drain back toward the works. The effect of this long line of main was to remove from the gas much moisture that had been condensed out and not precipitated in the works. The general scheme of connection afforded an opportunity to test the principle of divisional condensation, the cooling feature being under control, and while the frictional contact was not ample nor subject to adjustment, it was sufficient to assist materially in accomplishing the solution of the problem.

The first scrubbers and condensers, which I will call the primary scrubbers and condensers, were in tandem, gas passing through the scrubbers and condensers in order. A temperature of 120°, or as near as possible to that, was maintained at the outlet of this primary system. The temperature in the relief holder changed but little, often not over 5° being noticed. An average reduction of about 20° took place in the air condenser; these condensers being housed, it was possible to maintain some control of them. The secondary condensers were in a pair and a temperature of 60° was maintained at the outlet, a reduction of about 40° in this apparatus.

I do not wish to be understood as meaning that our conditions are perfect or that our system fully represents the proper idea of divisional condensation, as the proportional features of cooling are not perfect, and in scrubbing the chief dependence is on the excessive length of main connecting the apparatus. The best results cannot be obtained in this way, but it is a step in the right direction, and results obtained give encouragement to the belief that, with the principles of divisional condensation perfectly carried out, troublesome stoppages could be entirely obviated and the maximum candle power retained in the gas.

While the careful treatment of gas in the works for the removal of condensable matter with least loss of illuminants is important, it is of equal importance to consider the effect of condensation in the distributing system. When we remember that gas from the point of generation is saturated with water vapor, and is being constantly brought in contact with water even after passing the ordinary forms of cooling and scrubbing apparatus, as in the ammonia scrubber, purifier and station meter, we can safely assume that its saturation is satisfied at the temperature at which it enters the storage holder, and being there stored in contact with water, another opportunity is offered for absorbing it. The ill effects of this contained aqueous vapor on the gas, influencing as it does troublesome deposits, has long been recognized, and the early writers have pointed out the advantages of dehydrating gas, but only recently has the matter been given the serious attention that its importance demands.

The three great troubles directly traceable to excessive amount of aqueous vapor are frozen services, liquid deposits in pipes and meters, and naphthaline deposits. Of the first two little can be added to what has already been written upon the subject, as it is self evident that with a gas freed from moisture these troubles could not occur, and it only remains to be determined what means and what limit of expense are necessary to accomplish this object. Of the third, while it is generally accepted as true that naphthaline is precipitated coincident with the precipitation of water, and that by thoroughly drying the gas this naphthaline deposit will not occur even at extremely low temperatures, it unfortunately has not been made perfectly clear how this occurs. As naphthaline is an anhydrous crystal, changing into the crystal directly from the gas, and as it is not solvent in water, there can be no affinity between them, so the precipitation must be mechanical. A reasonable deduction would be that the naphthaline crystals are present in the gas in microscopic size, and, owing to their light gravity, float along in this form in gas currents. Should there be no water vapor present, or should the water vapor be permanent, no precipitation could occur; but as the water vapor is condensed out it is for a time carried along, until, forming into vesicles, falls by gravity. In the course of this formation of vesicles naphthaline crystals are incorporated in them, assisting in their formation mechanically, and consequently are precipitated with the water. No matter what theory proves to be the correct one, if it be fully determined that water vapor assists in the deposit of naphthaline, the proving of the theory would only be of interest to the scientist. Our interest is to determine what degree of dryness is necessary to accomplish this object, and how it can be done in a practical and economical manner.

As the gas after leaving the storage holder is subject to the influence of a wide range of temperature (often over 100° in annual changes) over which no control is possible, any device for controlling the condition of gas before its final entry into the distributing system must be placed at the outlet of the holder. As there is a natural hesitancy to assume any risk of a possible interruption to gas supply no device is likely to meet with favor that does not insure against such interruptions. No drying process by absorption is uniform in action, and there is a possibility of accidental interruption to gas supply, so that our reliance must be on some form of condensing apparatus.

The variation of temperature surrounding gas mains is not great throughout the year, and if a uniform temperature was maintained at the outlet of the holder the effect of this variation would be reduced to a minimum. Under present conditions of gas delivery the variation in temperature of gas in the holder has more influence in causing variation of temperature in the distributing mains than the outside influence of the earth surrounding them, and should it be possible to maintain a uniform temperature within the mains there would be little trouble from stoppages, even in exposed services, as the heat contained would hardly be lowered sufficiently in the short time of passage of gas through the service to cause much precipitation of moisture, and the continual flow of gas would maintain such temperature as to prevent any freezing.

In order to maintain uniform temperatures at all times at the inlet of the distributing system, it would be necessary to have some medium which would be of uniform temperature throughout the year and be independent of weather conditions. For this purpose I suggest the sinking

of wells in the earth to a depth that would insure uniform temperature, and by passing water in a coil down in these wells we would have a medium under perfect control. Then by the use of the multitubular condenser with attending frictional contact, the gas could be maintained at a permanent temperature and all moisture possible be removed by frictional scrubbing. It would be necessary, of course, to have the capacity of such apparatus equal to the greatest hour's output of the year; but as the water would be of uniform temperature the apparatus would not need nice adjustment, and would require practically no attention; the water being uniform, an excess of it would do no harm. It may be urged that the cost of installation and attention would not be warranted by the benefit obtained. Aside from the satisfaction which good service would give let us consider the possibilities of saving. In the large cities the average cost of attending to each complaint is about 60 cents. This does not mean that a complaint man could not go out and free a single service for less than this amount, but for the total maintenance of such a department it fully equals this average. Add to this the loss of prestige and the possible loss of consumers, and also as it is often the case sacrifice in manufacturing results, with the hope of obviating the trouble at that point, it sums up in the course of a year such an amount as would justify liberal expenditure at the works to prevent the trouble.

In conclusion it may be added that while many difficulties would be encountered in the endeavor to solve this interesting problem it is not impossible. It rarely happens that any one man is so fortunate as to have opportunity to investigate the subject in all details, but by working along defined lines the work of many may be concentrated and ulimate success attained.

The Relativity of Economic Institutions.

[An address delivered by B. H. MEYER, Professor of Political Economy, University of Wisconsin, and Member of the Railroad Commission of Wisconsin, at the Thirty-third Annual Meeting, American Gas Light Association, Milwaukee, Wis., Oct. 18-20, 1905.]

"There is nothing new under the sun," says the proverb. Yet every rising sun looks upon a new world. This daily newness is more marked in the human than in the physical world. Compared with physical relations, human relations change rapidly. The unit of time by which many physical changes are measured is exceedingly long. The geologist knows only cycles. A few thousand years scarcely fall within the range of his perception. To him generations are not even seconds; to the student of human institutions a single generation may mark a multitude of changes. Men now living remember social, political and economic organizations which can be recognized only as survivals in what is seen about us to-day. "Community of interest" is only 5 years old. Its 4 or more antecedents are together less than 100 years old. Rapid transit came upon the scenes only about 25 years ago. The telephone revealed its wonders to the most of the present generation, and the telegraph is even younger than the railway. The whole catalogue of the mechanical inventions which have created this present new world is little more than a century old.

The block of wood which floats upon yonder waves probably describes the same peculiar figure which a similar floating object defined untold ages in the past. The force of gravitation attracts one particle of the universe towards every other now as it has always done. Cohesion, repulsion, attraction, chemical affinity and all the other elemental manifestations of energy have probably remained the same throughout the ages. The number of chemical elements is believed to have remained unchanged from the beginning, together with the laws of combination among them, although their discovery is still in progress.

Turning toward man, we find that certain fundamental human traits appear to be universal and eternal. Hunger, cold, love, hate, selfishness, altruism, and the whole gamut of human instincts, feelings and emotions are as eternal and universal as the law of gravitation, but the manner of expressing or satisfying them has changed. Men still need food, but the kind of food and its manner of preparation is different. Men still experience cold, but they protect themselves against it in new ways. Men have always acted together for common purposes, but the forms of common action change from year to year and from place to place.

There are men—philosophers and metaphysicians—who have attempted to formulate that which is universal and eternal into laws. The number of these eternal laws relating to the world of matter is relatively large; the number relating to human affairs is small. So far as I know, no one has yet attempted to formulate more than about a dozen universal laws affecting human society, and these are of doubtful validity. Only a small part of the economic and social life of man is capable of formulation into laws which are universal and eternal. All the rest is transient and changeable. Human habits, customs, morality, and religion even, change from decade to decade among people of the same nationality, and generally differ among contemporaneous peoples of different nationality. Morality itself is largely a relative form, except in so far as its contents embrace certain principles of human action which have received general acceptance at all times, in all places, and under all circumstances. Honesty with us is not necessarily honesty in every other part of the world. The accepted methods of conducting business in one country generally do not prevail in all others; and the business methods of to-day are different from those of yesterday. Various conceptions of the State have succeeded one another in the course of centuries and the functions of the State have been restricted or extended as time, place and circumstances have dictated. Wherever the mind is directed, relativity rather than absolutism reveals itself. A few things appear to be rigidly fixed, absolute and eternal. All the others are subject to the law of change.

The State itself is relative rather than absolute in its organization. No sooner have definite limitations of the functions of the State been established, and dogmatists have formulated their rigid theories in accordance with these, than some unforseen event will arouse the public mind and with one sweep the encrusted dogmatic generalizations will be wiped out of existence and the functions of the State adapted to the new conditions. The history of the theory of the State records many different forms, varying between the extremes represented by an all-illusive leviathan and a colossal policeman; but whatever theory may have prescribed with respect to the number of the functions of the State, in the practice of historical States this number has never been capable of rigid limitation, for the reason that changing conditions within and without the State have compelled the exercise of new and and the abandonment of old functions. We ask, for instance, whether the separate States of the federal government shall make and enforce sanitary regulations? No sooner has the answer been given that this is a function of the separate States, than a yellow fever epidemic adds it to the functions of the federal government. We ask whether the State shall inspect our foods, and we receive the answer that intelligent people will eat only what is good for them, that the State may well leave it to each individual to select wholesome things to eat. Scarcely has such an answer been given than impure and deleterious substances are found in our foods which none but trained and expert chemists can detect; and the establishment of dairy and food inspections is the result. We argue that the farmer may control his herds, but tuberculosis among milk cows compels the State to take much of this control from him. The birds in the air and the fishes in the water come within the range of the influence of the State.

Nevertheless, the functions of the State have their limitations. These limitations are not found in dogmatic theories regarding the functions of the State. They are fixed by the *concrete conditions which exist within the State*, and under which the State itself exists; and the limitations as defined for one State are different from those of another. One State buys bread for its inhabitants; another buys a controlling interest in a coal syndicate; another runs a lottery. Still other States do all or none of these things. Obviously, no absolute and perpetual law controls the functions of existing States.

Before discussing some of the considerations which place limitations upon the functions of the State, attention may be directed towards the instrument through which whatever function the State does exercise must be performed. This instrument is the government.

Government is frequently represented as something separate and apart from the people; something idealistically strong, efficient and upright. It is asserted that the government can or cannot do this or that thing, because it is assumed that government represents some abstract qualifications which are different from those which are attributed to the people for whom what is called the government acts. This point deserves to be emphasized, for on reflection it will be recognized as common experience that when men argue whether or not "the government" should or should not do a certain thing, they rarely inquire as to what constitutes this government concerning which they argue. Government is strong, efficient and upright only so far as the persons who constitute the government possess these traits. Government is weak, inefficient and dishonest when weak, inefficient and dishonest men are elected or appointed to government positions. In other words, government is not an idealistic, abstract something with remarkable or superhuman powers, but an earthly arrangement composed of men who are human like all men outside of the government, and who pos-

sess the strength and the weaknesses of the rest of mankind. Men who are in the government are what they were when they were still outside of the government. Some men have a passion to serve their fellows; others to exploit them. The impulses to a higher level of action which connection with the government may impart to some is probably offset by the opportunities for evil which others discover through their connection with the government. The average qualifications of men remain the same after as before their connections with the government have been established. It will, therefore, be well to bear in mind that whatever may be said with respect to the functions of the State must be conditioned upon the qualifications and character of the men who, under the name of government, must perform these functions.

It follows from what has just been said that the character, ideals and traits of the individuals within a nation constitute one of the best defined limits of State action. Where each individual within a State desires to retain the greatest possible field for the fullest and freest exercise of his own powers, the functions of the State will be fewer and less comprehensive in their scope than where each person looks to the men who constitute the government for directions as to what to do and when to do it. The one man asks, "What can I do for myself?" The other, "What can I get the State to do for me?" The policy of a government can do much to encourage or discourage these two types of men, irrespective of the natural inclinations which each may possess. In those States in which the government reaches out into the industrial field and extends the influence of direct State action to the farthest possible limits, the individual is perforce educated into an attitude of dependence upon the State. Where governmental policy throws the individual upon his own resources and protects him in the free exercise of his powers in the widest possible field, a different type of individual is developed. In this comparison of different types of individuals, persons of the same general intellectual, moral and physical endowment must be assumed, subjected to the influence of different types of government. Persons who are endowed with different degrees of strength by virtue of such differences naturally assume different attitudes towards government. Those who are endowed with superior gifts, whether moral, intellectual or physical, may fearlessly appeal to the laws of free and unrestricted competition and the survival of the fittest. Those who stand lowest in the compound social pyramid, because of their lack of endowment and their weaknesses, are doomed to wretched failure in every regime of free and unrestricted competition. Between these two extremes are the masses of mankind, in themselves representing many different degrees of strength and capacity, who may appeal both to the individual and the State—the individual where personal effort is possible and desirable, and to the State where unlimited individual freedom results in harm or where the individual is too weak for the competitive race. The State, embracing so many different classes of persons, must consequently adopt principles of action wide enough to include them all. The State must preserve the principles of competition to develop efficiency; it must adopt forms of co-operative effort where competition fails, and it must care for its unfortunates.

Considerations of this kind are fundamental in an attempt to fix the limits of the functions of the State. Where the interests of the individual and the interests of the whole body of citizens are the same, the fullest exercise of individual freedom is desirable. Where individual freedom and public good are not identical, the interference of the State in its various forms must be invoked.

During the last 50 years many valuable pamphlets and volumes have been written on the subject of profit-sharing and co-operation. The principles and methods adopted by the Rochdale pioneers, a group of men in an English town of this name, who first successfully applied co-operation during the middle forties of the last century, have spread throughout the civilized world. In Great Britain and Germany co-operative societies modelled after the Rochdale plan do business aggregating millions. In the United States a considerable number of co-operating establishments have been founded, and profit sharing, in one form or another, finds practical adherents in every part of the country. The success and failures in co-operation, as represented by these societies, cannot be taken under discussion in this place; but it should be observed that, assuming complete success for all of them, the combined scope of their activity embraces only an inappreciable part of the whole industrial and commercial domain. The industrial world is held chiefly by three great competitors: First, by individuals; second, by corporations; third, by the State. In so far as co-operation as a practical plan of general application comes into consideration, the last two, the State and the corporation, are the only significant competitors. The corporation, like the State, is largely a co-operative society, The corporation and the State are the only important competitors in the field of public service. Excepting the police and other inherent sovereign powers of the State, the serious and vital question before every citizen is, "Shall the State or the corporation provide public utilites?" The answer to this question depends upon the character of the State, the nature of the corporation, and the relations which exist and can be maintained between the State and the corporations in each concrete instance.

Every industry may be said to be composed of two factors, the one private, the other public, combined in each industry in varying proportions. The business of the farmer is perhaps as private as any; yet the farmer is compelled to destroy Canada thistles and other obnoxious weeds; he cannot arbitrarily deflect the water which flows over his farm; he cannot unduly dilute the milk he sells; he cannot keep infected herds; he cannot shoot game in his forests in all seasons of the year nor fish with all kinds of nets. The State interferes with the farmer in the interests of all the inhabitants of the State. The operation of a planing mill is a private busines, but the State prescribes certain safeguards against accidents and makes sanitary and other provisions affecting employees. Factory legislation is only a little over 100 years old, and the legislation of to-day is infinitely more detailed and comprehensive than it was in the beginning. The factories of to-day and the social and economic conditions under which factory workers perform their labor at the present time are very different from what they were during the earlier decades of factory development. The contents themselves of the public and private factors in industry have changed. In these changed relations we find the source of the social and economic problems of to-day. Generally speaking, the right and the duty of the State to interfere in the conduct of business and the management of industry on behalf of the population as a whole grow in proportion to the relative size of the public factors involved in each industry. A theoretical illustration may bring this out more clearly. Agriculture has been mentioned. Suppose we represent agriculture by 10 units, 9 of which we will assume are private and 1 public; next we may place, say, the manufacture of bricks, represented by 8 private and 2 public units; the mining of coal by 2 private and 8 public units. Continuing a similar arrangement of all the other industries, the relative number of public units increases as the private units decrease, until we reach the post office, the telegraph, the telephone and railway, with 1 private and 9 public units, including elements of monopoly, at the other extreme. Of course, this is only a theoretical illustration, but it serves to bring out the different degrees of interest which the State, acting on behalf of all its citizens, has in the conduct of different classes of so-called private industry. For more than a quarter century the courts have held that where a person devotes his property to a use in which the public has an interest, the government has a right, and it is its duty, to interfere if necessary in the interests of the public, to the extent of that public use. State interference or control grows with the size of the public factor in each industry and occupation. In this we find the necessity of and the justification for the relatively large control exercised by the State over banks, insurances companies, electric light and gas companies, tramways, electric and steam railways. When a large public use of private property is coupled with monopoly, the necessity for State interference is even more urgent than where the element of monopoly is absent. The private ownership of a monopoly vests the owner with a power over others, exercised directly or indirectly, from which there is no escape by virtue of its being a monopoly. A monopoly in the hands of a good man is like a beneficent despotism; in the hands of a bad man it becomes intolerable tyranny. It is not the use of the power of monopoly against which people protest, but rather its abuse. And in order to protect themselves against the abuse of such a power, the action of the State is invoked. No intelligent man is willing to be placed in a position where he can no longer be master of himself and of the means of life and prosperity. He may be entirely willing to become dependent upon others for many things. Mutual dependence with interdependence is the keynote of modern society; but no man ought to be expected to acquiesce in a situation which controls his well being, and over which he himself in turn can exercise no control. Upon this simple fundamental fact rests the deepseated and widespread and persistent demand for government control of monopoly and of all industries to the extent to which they are devoted to public service.

An excellent pamphlet issued by the Milwaukee Gas Light Company recognizes frankly at the outset that the Company is a public service corporation; that as such it enjoys certain privileges from the State, which in turn impose obligations in the nature of public responsibilities. "These responsibilities," says the pamphlet, "are of a character that indissolubly link public interests with the interests of the Com-

pan[illegible]." It may be added that where the interests of a public service corporation or of any other kind of a corporation are in harmony with the best interests of all the people of the community, the fullest individual freedom may not only be granted, but should be granted. Where, on the other hand, the interests of the corporation and the interests of the public are naturally at variance with one another, or where they may become antagonistic to one another, power must be given to the government to interfere when public interests demand it. Legislation which provides for such interferences is not in itself an impeachment of the integrity and honor of every man connected with the corporation to which it applies, any more than legislation punishing thievery accuses every living man of being a thief. The law simply says that if a man steals he shall be punished thus and so. The law compels parents to send their children to school, but it does not assume that most parents would not send their children to school without the law. The law punishes ruffianism, but all men would not turn ruffians if such a law were not in existence. Aside from the educational and restraining influence of a great code of just laws upon the whole population, it may be truly said that the most of our laws exist in order that proper weapons may be turned against the relatively few who do wrong. They may do this wrong because of their own incapacity, selfishness, greed, or any other anti-social qualities of which they may be the unfortunate possessors. The welfare of the whole population demands their restraint. In the welfare test of the whole population, and only there, do we find the limits of the exercise of State functions. The functions of the State can be limited only by human welfare.

Once more permit me to refer to the pamphlet of the Milwaukee Gas Light Company. It explicitly welcomes "Proper and intelligent State control." This is advanced ground for a corporation to take. It must be a matter of common knowledge that not a little of the feeling which the public has occasionally shown in the matter of public service corporations has been the inevitable result of a short-sighted policy on the part of the companies. Unlike the position taken in the pamphlet of the Milwaukee Gas Light Company, the public has too often been told that the gas business was purely private business like any other, and that no interference on the part of public authorities would be tolerated. State interference has been fought inch by inch. This may have been natural. It was, nevertheless, short-sighted; for the public mind, incapable of fine discriminations and always ready to generalize, soon became convinced that all public service corporations were primarily bent upon the greatest possible exploitations of the masses of the people. In spite of the errors of the past, a public service corporation which to-day takes the public into its confidence, and which lays proper stress upon the word service, has nothing to fear from the public and from the government acting for this public. Herein lies a hint to the answer to the question which constitutes the title of the pamphlet alluded to twice before, namely, "Gas Monopoly: Shall it be private or socialistic?"

At the outset it should be observed that these two words, "private" and "socialistic," in themselves convey no arguments; nor can the application of either to an existing or proposed institution make it either good or bad. The fact that the adjective "private" or "socialistic" is made to apply to a form of enterprise makes that enterprise neither successful nor unsuccessful. The overwhelming majority of men are adherents of private property; yet they all accept and support certain socialistic and even communistic arrangements. The question before us is solely one of degree, not of kind. Our public schools, our highways, streets and sidewalks are communistic arrangements. To that extent we are all communists. Municipal water works and street railways and the United States post office are socialistic institutions. In other words, all, or at least the most of us, have already consciously or unconsciously accepted together the principles of individualism, socialism and communism, and the real question before us is, which one of these principles, or what proportion of these principles in combination with one another, shall we accept in each particular case? We may leave out of consideration entirely the extremists, who would make our society completely and exclusively individualistic, socialistic or communistic. They are in the minority, and whether they shall always remain so, as I sincerely hope they will, depends very largely upon the success with which the three principles can be combined by those who are unwilling to submit to the one-sided rule of any one of them. Taking human nature as we find it to-day, as it has been known in the past, and as in all probability it will remain in the future, the exclusive application of one of these three great principles, individualism, socialism, communism, to the exclusion of the other two, would result in a social organization so one-sided, warped and intolerable that most of us would attempt to escape from it. The most desirable organization of society embraces these three principles in varying proportions, depending upon time, place and circumstances. It is not a question of one *or* the other, but of one *and* the others. And in determining the varying proportions in which these three principles are to be combined, the most careful consideration must be given to the development of the individual as an independent, self-supporting, self-directing member of the community. Too wide an application of the principle of socialism prevents the highest development of individual strength, initiative and self-reliance, while the uncontrolled activity of individual freedom leads to the exploitation of the masses by the conspicuously strong and the unscrupulous. The regulative power of the State must step in and create and maintain a proper equilibrium among these various principles and classes of men.

Returning now to the specific question, whether the gas monopoly shall be private or public—which is the question which I have been requested to consider in some of its aspects in this address—I desire to say in advance that I am very ignorant regarding the gas business, and all I shall have to say relates to certain general propositions which I believe enter into the consideration of the question of the public ownership of all kinds of public utilities.

First of all, the relativity of all economic institutions should be recalled. Because some English, German or other European city has had a certain experience in the municipal management of certain public utilities, it does not follow that such experience could necessarily be made universal, or that Milwaukee or Madison could, without further consideration, enter upon the same undertaking with the same results. Those who should be qualified to speak tell us that no full and reliable data are at hand on the basis of which municipal ownership can be intelligently judged. The Civic Federation has recently undertaken to collect information which shall be thoroughly comprehensive and reliable, and the results of the work of the Federation should be of great value to the American public.

It can hardly be said that public opinion in America has crystallized upon the subject of public utilities, except in so far as party platforms and occasional municipal elections have given more definite form and expression to this opinion. Party platforms and public elections have frequently been influenced by local experience with public service corporations. Where a public service corporation is efficiently and honestly managed, there is nothing to arouse public sentiment and to precipitate an acute discussion of the status of such a corporation in platform or tribunal. Where, on the other hand, a public service corporation is inefficient or corrupt or both, even an unimportant occurrence may develop public sentiment favorable to radical action. Not long ago for instance the whole population of Madison was excited because the local street railway management of Madison quietly set to work one Saturday night to set poles upon disputed ground. In other cities similar lawlessness has been resorted to. Likewise, and for similar purposes, water and gas pipes have been laid during the night and on Sundays. I express no opinion with reference to the merits of the controversy in Madison or in any other city, but I do wish to say that any citizen or corporation which resorts to the cover of night or the laws governing the Sabbath, in order to accomplish what should be done only on the basis of law and in strict accordance with law, richly deserves to be driven out of town as an outlaw and criminal.

During the sessions of the last Wisconsin legislature half a dozen or more bills were introduced authorizing municipalities to own and operate public uiilities. These bills represented generally speaking the principle of local option in the matter of public ownership. This is much to be preferred over any general, perhaps compulsory, scheme which might be devised. Relativity in economic institutions asserts itself again here, as in so many other things. One Wisconsin city may make public ownership and operation a success, and another a failure. One private public service corporation may provide good service and another may not. The citizens of each locality can best be trusted with the decision. The masses of the American people are eminently practical, and they have a distinct tendency to introduce their practical ideas into public as into private affairs. In few if any localities is it likely that dogmatic assertions regarding State functions will ever decide the practical question of public ownership. The average citizen wants a reasonably good service at a reasonable price. Whether this service is rendered him by the State or by a private corporation will generally cause him little concern as long as he is satisfied with what he gets. Relatively few people are monomaniacs upon the subject of public ownership. It is only when people cannot get what they have a right to expect that agitation begins.

At this point it may not be without interest to remark regarding the

manner in which public service corporations become objects of public attention. Common history records events somewhat as follows: To begin with, the public service corporation receives its franchise from the city through the council, responsible to the people. After the franchise has been received, the managers of the corporation establish the plant, and very naturally follow the lines of highest profits. The limit of their gains is their ability and their character. They possess a free field, for their business is either partially or entirely a monopoly. The first managers perhaps divide increased profits, arising out of a growing population and economies, with the public, in the form of reduced prices for the services rendered. Then comes a change in management and policy. Capitalization is increased, and increasing returns are absorbed in interest and dividends on fictitious capital. The wisdom of the initial policy is lost, and a policy of reckless financiering and exploitation resorted to. The temptation is great. A small increase in price means enormous gains. Greater gains are within reach and the price is raised or the service depreciated until the public begins to complain. Agitation is begun against the renewal or continuation of the franchise. The corporation juggles figures representing prices and earnings, and fosters a counter agitation—*and there we have the active entry of the public service corporation into politics.* The corporation fixes its eye on the city council, from which it hopes to get a renewal of its franchise. It nominates aldermen who secretly favor a renewal. It publicly discredits candidates who oppose a renewal. It "reasons" with voters and candidates and "convinces" by all available means, including money; and of all forms of graft, franchise graft is by far the most demoralizing. Police graft, payroll graft and contract graft are bad enough, but franchise graft is infinitely worse. Through the former classes of graft the public is robbed of smaller sums—$25, $50, $100 or $1,000—through the latter it is robbed of millions. A long term franchise in the hands of an unscrupulous, unregulated and uncontrolled public service corporation is one of the most powerful weapons of extortion which the hand of man can contrive; and every time a franchise is to be renewed or extended there is danger of the same powerful corrupting influence. In this respect the experiences of many American cities are scandalous in the extreme, as all the world knows. It is doubtful whether any evils which are likely to appear in connection with public ownership could exceed in seriousness those which have just been pointed out in connection with private ownership. Public ownership must be decided upon other grounds than those of business and public morality. Could anything be more corrupt than the management of certain life insurance companies? An examination of other great enterprises might reveal practices and methods as bad as those of the insurance companies which are now under investigation. The charter of the Public Service Corporation of New Jersey, for example, expressly permits exactly that kind of graft on the part of its officers which was the cause of several post office officials in Washington being sent to the penitentiary about a year ago. Permit me to read from this charter. [Read extracts from charter.]

As a matter of fact, it is probable that, in spite of all the evils which have been exposed in public life, the morality which controls the conduct of our public affairs is appreciably higher than that which prevails in private business. In the management of private business men daily do that which if done in public business would result in their immediate retirement from office, and possibly also conviction of crime. But the consequences of dishonesty or other lack of virtue in public officials are infinitely more dangerous to the life of the community than similar evils in private business. This is probably one of the reasons why some men lose faith in the ability of the State to do anything with success, and advocate the limitation of the functions of the State to those of a policeman. Unless a man is optimistic enough to believe that increased functions of the State will at once develop a higher grade of public servants, he must insist that the municipality shall own its officials before it takes charge of the ownership and operation of its public utilities. On the other hand, the evildoer in a public office has generally fewer facilities at his command than a similar character in private business. Public business involves public accounting. This accounting restricts the financial resources of the scoundrel. He cannot have hundreds of thousands and millions of dollars subject to arbitrary and corrupt disposition by himself without an accounting to anybody. It is more difficult to locate the scoundrel in private than in public business, and having once located him, he can be removed with greater ease under the influence of an aroused public opinion than is possible in private business, where personal pull may interfere. Personal pull may, and does, interfere also in public business, but generally speaking it is probably true that a public official committing wrong in managing a municipal enterprise could be detected more easily than a private official, for the reason that the resources of the former are much less extensive, and opposition will concentrate in him with certain effectiveness. I am well aware that conspicuous illustrations from American municipal life can be cited in refutation of this proposition; but I do not believe that these illustrations, in spite of their notoriety, can quite overbalance the counter illustrations which may be brought to bear upon this point.

Another point to be considered is that of profits. By taking away from the managers of a property the incentives and possibilities of private gain, there is removed one of the greatest factors of efficiency and economy. In this respect public management is bound to be weak as compared with private management, until a very high state of efficiency, pride, honor and integrity of official life is developed.

In a word, the problem of municipal ownership is to-day primarily a local problem, to be decided in the light of the conditions which prevail at each particular place. The existing management of public service corporations, as well as the quality, temper and tone of the officeholding class, and the sentiments of the population as a whole, must be inquired into before an intelligent decision can be reached. I am not underestimating the virtues of the American people. I firmly believe that they are as honest and as efficient as any in the world; but this new American civilization of ours has many loose joints. Adjustments have not all been made; we make mistakes and attempt to correct them with good cheer, and our political and economic arrangements frequently lack finish. We look at all these things with a light heart, because we say we can afford it. These things leave room and loopholes for inefficiency and dishonesty. Herein lies one of the fundamental differences between Germany, for instance, and the United States. Until a city is in the hands of honest and efficient men, and the government of a city is administered in a businesslike way, municipal ownership will remain a most uncertain proposition. Of course, all these arguments may be summarily swept aside if the frequently stated proposition is admitted, which I am not willing to admit, that it is impossible to have an efficient and businesslike city administration until after the chief sources of corruption and inefficiency have been removed through municipal ownership.

Passing from the narrower field of municipal operations to the larger domain of the railways, an entirely new set of considerations must enter into view. Like municipal enterprises, the railway represents problems of financial administration, technical efficiency and service; and in addition the railway is the very key to individual, local and national prosperity, and profoundly affects international relations. The problems of municipal ownership are relatively elementary; those of the State ownership of the railways are complex and exceed in magnitude all the others taken together. Among the countries that have acquired and operate their railway systems, Prussia stands foremost in the list. Prussia has been eminently successful in the management of her railways from every point of view, and the results of the operation of her railways challenge comparison with any other railways in the world. A few remarks bearing upon the railway situation in Prussia and in the United States appear to be pertinent.

Compare, for instance, the geographical extent of the two countries, and the diversities in industrial and social interests resulting from the same. The United States, exclusive of Alaska, is 15 times as large as all Germany, and Prussia embraces about ⅔ of Germany. The well disciplined, trained and tried Prussian official, with centuries of tradition of honor and pride in the public service back of him, finds his place in an elaborately wrought, nicely-balanced, and well-adjusted administrative system, with all the safeguards and checks which a continuous political existence has created. To serve the State to the best of his ability is the pride and honor of the typical Prussian official. In the United States, while there are thousands-upon-thousands of men in all grades of the public service, from township assessor and village president to cabinet officer, who give themselves up completely and at great personal sacrifice to the duties of their respective offices, and maintain an unexcelled standard of efficiency and of honor, every American citizen with his eyes open knows that such is not the dominating spirit of our public life. Our administrations are pervaded by a different spirit, and the misuse of public positions is a matter of daily occurrence. This being so, who is there who is willing to turn over to men of such type the enormous transportation interests of the United States? The discipline and efficiency which characterize the forces of our great railway companies would, in all human probability, be subverted into mediocrity, if not irresponsibility. But granting even that this might not occur, and assuming that government ownership in the United States might be made the lever for a reform of our administrative life, there would still be vital objections to State ownership and operation in this country. These objections lie in the great expense of our

territory and the magnitude of the conflicting interests which it represents, all of which would find instantaneous and vigorous expression in the demands for changes in classification and rates. Twenty years ago it took 3 capable men a long time to reach a conclusion regarding the differentials between New York, Philadelphia and Boston. Within the last year some of the ablest minds of the country have been occupied in an attempt to solve this same problem. After hearing a great deal of testimony and many able arguments, the Interstate Commerce Commission handed down its decision with respect to the differentials as they stand to-day. They are the claims of rival ports, of rival inland cities, of rival producing and consuming areas. Under a system of government own ership all these conflicting claims would have to be adjusted by the central administration. This means that all along the ranks of our official life men would appeal to their friends and constituencies on the ground of the details of railway problems. It does not take much imagi nation to conceive of the candidate for congress appealing to voters with a promise of certain rates on beans, or cheese, or calico. Now, all these are vital questions; but, excepting in their larger aspects and from the point of view of general policy, they are not questions for the political platform. A political vote should not decide the rate on wheat from Dakota to New Orleans as compared with the rate to New York. It should not decide whether Missouri or Michigan or Georgia or Washington should sell lumber in a certain market, and whether the coal of Pennsylvania or Illinois should be used. Under a highly developed political system such things may be possible, but in the United States, where the theory and practice of administration lag far behind, the experiment of government railway ownership would be a dangerous leap into uncertainty.

A practical illustration of what has been indicated as a possible result of government ownership in the United States is found in Switzerland, where all but one of the railways have been acquired by the government during the last 6 years. No sooner had the State assumed control than avalanches of demands and complaints and petitions were rolled upon the administration. There were demands for shorter hours, higher wages, more trains, lower fares and rates, finer stations and cars; in short, universal and immediate improvement. The railways, it was understood when the State purchased them, should not be used as fiscal harvesting machines; yet a balance between receipts and expenditures had to be maintai ned. It has been maintained, but only through the most vigorous oppo sition to the inroads of radical demands. No government can long withstand the clamor of an insistent populace. Prussia and Switzerland have successfully met the situation, but under present conditions it would be more than bold to venture upon a similar programme in the United States. Prussia and Switzerland can if they choose decide matters of rates partly as they do matters of taxation, for within limits it is for those governments a question of the relative justice of taxes remitted or collected in the form of railway rates or in the form of ordinary taxation. In the United States, under private ownership, this phase of the railway problem is largely a matter of equity in dealing with stockholders' money; but under government ownership it would be largely a matter of equity and prosperity on the part of competing territorial areas, each of which is several times the size of Switzerland or Prussia.

The day may come when the people of the United States will be compelled to resort to government ownership of the great transportation systems of the country. Whether or not that day will come depends upon the manner in which the great railway properties are handled. The choice of the nation lies between private ownership with effective control and government ownership. Regulation and control are still on trial. If regulation succeeds in establishing and maintaining just relations between carriers and public, protecting each interest in its legitimate rights, no programme of government ownership can gain headway. Should regulation when once adequately inaugurated fail to satisfy the just demands of the people, State ownership is inevitable; and if it must come, in spite of all its difficulties and dangers, the people of the United States will not permit it to fail.

In comparison with the railway, the telephone and telegraph represent problems very much simpler and easier of solution. None of the arguments which can be urged successfully against government ownership of railways in the United States apply to the telegraph and telephone. Great geographical areas, competing producing and consuming sections, inequalities in natural advantages, diversities in industries, differing social and economic conditions—none of these make themselves felt in the management of telephone and telegraph. The conditions which have justified government ownership of these means of communication in England and Germany prevail also in the United States. There can be no question about the possibility of very greatly extending the use of the telegraph and telephone in the United States far in excess of what private ownership has thus far made possible. The division of ownership of telephones stands in the way of progress, and under government ownership unity in management would undoubtedly facilitate a more extensive use. Following the acquisition of the telegraph in England by the government there was a marked increase in the number of messages. People who had formerly sent telegrams only in cases of emergency, then used the telegram freely for business and social purposes. With only one telegraph and one telephone in the field, conservatively managed by the government in the interests of the whole population, there is every reason to believe that hundreds of thousands would avail themselves of these means of communication who now use neither. Under civil service rules, managers, operators and other employees could be enlisted in the service at fair salaries and wages, who could maintain the highest efficiency and keep out of the business those elements which would prejudice a similar venture in railway enterprise.

Some of my auditors have before this doubtless thought that the general propositions and arguments which have been advanced hitherto should be supported by statistical and other data; but I beg them to remember that the statistical results of private and municipal operations in the United States and other countries are to be presented by others, and that I was requested not to deal with statistical results. In this connection attention may be called to the reports of the United States consular officers upon the subject of municipal operation in Europe. It is a significant fact that these reports have generally been favorable, irrespective of the previously maintained views of the reporting officer. One of the greatest difficulties in the proper interpretation of foreign reports is the absence of a common basis of comparison. The lack of uniformity in municipal accounting in the United States is notorious; and comparisons between foreign and American cities are even more difficult to make than between American cities. In view or this situation, the investigations of municipal operations which the Civic Federation is at present organizing will be of incalculable value to every citizen in forming an intelligent judgment upon these important subjects. Men may honestly differ from the question of the probable influence upon city government of an extension of municipal operation. One man may hold that private ownership of public utilities is the chief cause of corruption in municipal affairs and that pure government can never be established until the city manages its public utilities. Another man may hold that corruption grows with growing functions of the municipality, and that a restriction of the functions of city government is the sure way toward reform. I say, men may honestly differ in regard to these two theses. In the absence of conclusive evidence the dispute is bound to continue, for it is largely a matter of opinion. It is not a matter of opinion, however, whether the citizens of one city pay 50 per cent. more for gas than those of another; whether they pay a greater car fare with fewer and poorer cars; whether they drink polluted water and pay a high price; whether the telephone costs $20 or $100 a year; whether they pay high taxes and have much to show for their money, or whether the money which the tax gatherer collects goes into wasteful and fraudulent channels. These are questions of fact which I hope the Civic Federation will be able to answer. We want to know what the situation is in foreign and American cities with respect to the quality of the service, the cost to the consumer, the financial results of municipal and private operation, wages, salaries, hours of labor, the labor contract, standard of living, and all other relevant facts. These statistics must in the first instance be verified from the books of city auditors and accountants of private public service corporations, in order that all figures may be fairly comparable Statistics may be culled to prove either side of any question; and unless the statistical results of public and private operation are honestly and thoroughly edited, no conclusions can be based thereon. Any number of volumes of comparative statistics cannot be regarded as conclusive, except in the light of fundamental principles of human nature, national traits and social and economic institutions. These appear to me to be rational propositions for the conditions of the present.

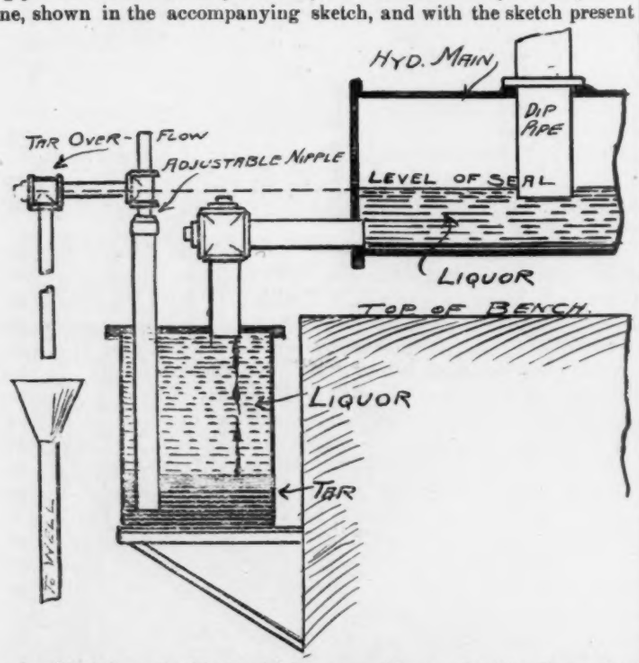
"Horse Sense" vs. Naphthaline.

By F. C. Slade, M.E.

If a man travelling around the country meets a number of men at different places who are particularly fond of welsh rarebit (for instance) and if all these rarebit fiends have some particular malady which malady ceases when they cease eating rarebit, then the average man would take it for granted without much thought that the rarebit caused the malady.

The writer in his travels around has visited a number of companies that are troubled with naphthaline, and a number of other companies that have been troubled with naphthaline at some time in the past—reference is made more particularly now to coal gas companies. A

little conversation with the latter companies has resulted in the fact that the same course of procedure in every case in a general way overcame the trouble, and by a very simple process of reasoning the immediate cause of the trouble has been determined; therefore, the writer takes the liberty of stating that the same course of procedure in any coal gas works will remove the naphthaline trouble. I accordingly took the trouble to present my ideas of the remedy for naphthaline, shown in the accompanying sketch, and with the sketch present



a simple statement of facts which may not be a scientific diagnosis of the case. The statements are nevertheless facts, but whether it is the whole story or not I do not presume to say.

The facts are that if the gas is brought into intimate contact with the tar between the hydraulic main and the purifiers, naphthaline will be formed and will crystallize out at the first point where the gas is suddenly chilled, and if the tar is removed from contact with the gas and the gas is brought into intimate contact with the gas liquor the formation of naphthaline will be prevented.

The sketch shown herewith is designed to accomplish the removal of all the tar from the hydraulic main and to return by displacement the light oils and liquor with an automatic overflow for carrying off the tar. Practically all the tar valves on the market are designed to take the tar off the bottom of the main, but notwithstanding this fact the hydraulic main has a way of filling up with tar almost unknown to the superintendent.

The writer invites discussion of this snbject, and would suggest that managers troubled with naphthaline should look carefully into their hydraulic mains and see if conditions do not exist as described above.

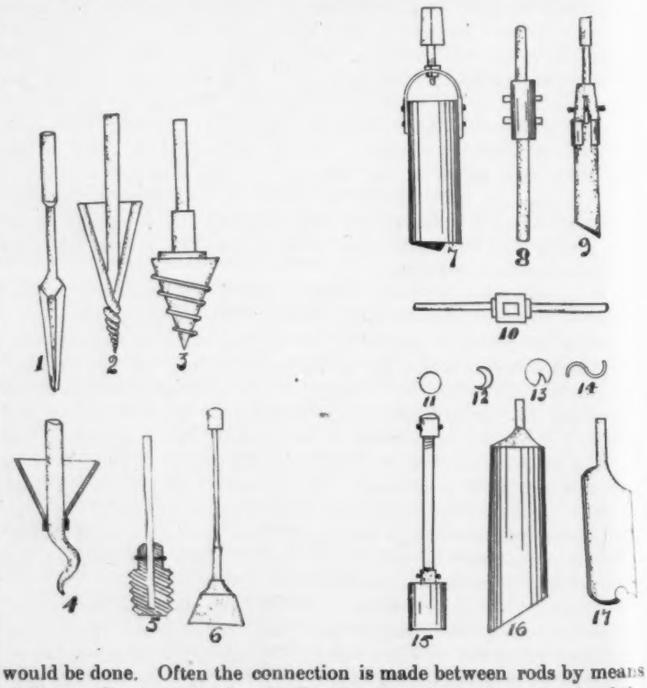
Boring for Gas.

By "Inspector."

I often find some singular or odd sorts of boring contrivances in use for boring for gas, and herewith name a few in connection with the cuts. There are, of course, a great many exceedingly well constructed boring devices in use, quite up-to-date in every detail, still one finds many out of-date devices yet in the service. I will refer especially to the latter kind in this article, as a matter of interest and curiosity. The usual circular motion is imparted to practically all of the boring contrivances, and as a rule the motion is imparted to the boring tool at the top of the bore. In common descriptions of strata the mere weight of two men bearing upon a lever attached to the head of the boring tool is ample to produce penetration; but in rocky strata, the chisel forms have to be used and these are struck down by repeated blows. The elastic wood pole is sometimes used with the free-fall system of boring, and then again lines of rods with screw connections may be seen in service. The tapering-shaped tool shown in Fig. 1 has been used for boring purposes in foreign countries with effective results. I saw some of this form of tools in Japan and Hawaain Islands. Places suspected of retaining gases are drilled into with this tool and gas reservoirs are often tapped. Sometimes considerable rigging is used in the operation of the drill. Again I find the simplest of devices employed for this purpose. In recent years the builders of boring devices have shipped many apparatuses to foreign lands for boring purposes and these machines may be seen in practical service.

In Fig. 2 is shown a form of screw-pointed boring tool that I noticed, which tool is rather peculiarly designed. There is a cone-shaped cup arranged as shown that goes downward to the screw-point. The tool is caused to revolve by levers, and when it is inserted into the sands the latter are received over the edge of the cup. When the cup is filled the instrument is raised for emptying. In Fig. 3 is shown a useful boring bit, of the cone order, with spiral edges about the oval surface as shown. This tool is used when the substances to be drilled are hard. The weight and pressure of the tool force it into the substances, causing a breaking up and lifting of the same. The style of drill seen in Fig. 4 is seldom used for purposes of boring for gas in the United States. It is one of the crudely constructed devices employed by the native boring parties of Guam. I stopped over one day at Guam, while the transport on which I was journeying was loading with products and unloading supplies from the States. I then had an opportunity to observe the systems of boring by the natives. The tool is a stout metal shaft operated by a hand lever at the surface of the earth. The saucer-shaped affair is fixed to the shaft as shown, and is the medium by which the loosened earthy matters are lifted to the surface of the earth. One of the odd forms of boring devices I noticed in another place and used for tapping for gas is shown in Fig. 5, consisting of the shaft for reaching down into the hole and the peculiarly designed threaded headpiece. The headpiece is a solid section of steel, deeply cut with threads, and is connected to the lower end of the boring rod by means of a key. The object of the threadwork is to form a means by which a bore already cut may be enlarged. The base hole has to be made first, and then this instrument with its sawlike sides is scraped up and down, evening off the bore and making a straight up-and-down hole. Another type of enlarging and evening tool for holes already penetrated is portrayed in Fig. 6. The lower or cutting edge is shaped like a chisel, and as the tool is lowered through the bore it is twirled enough to scrape the sides of the bore. A cylindrical form of boring tool is illustrated in Fig. 7. This hollow cylinder is made of sheet steel, lapped and riveted, with the lower edge formed as shown and sharpened to a cutting point. Inside is a drop valve, so that when the sand is forced up into the cylinder and the cylinder is lifted the valve closes, holding in the earthy substances.

Rods frequently broke in the work as I observed, then patching



would be done. Often the connection is made between rods by means of the coupling with keys as in Fig. 8. Sometimes the union is of the design presented in Fig. 9. Fig. 10 shows a form of hand lever utilized for operating the rods at the top of the well. The head of the rod is squared off and the socket of the lever fits over this headpiece. Thus a very firm grip may be obtained on the rod. Fig. 11 shows one form of the cutting edges of the drills. I find that some of them describe perfect circles as in this diagram, while others are of the half-

noon description, as shown in Fig. 12. Again, some of the cutting edges of the boring tools are modelled according to the broken circle edge, as shown in Fig. 13. A great deal depends upon the character of the substance to be drilled through. Some of the strata is soft earth or loose sand, while again we find instances of hard rock, slate and small stones. For the latter service the tool possessing an edge of the S shape design, as in Fig. 14, is used to good advantage. Fig. 15 illustrates the design of weighted end utilized in certain lines of work. When the free-falling system of boring devices is used the weighted connection is often adjusted in the rod, to add to the force of the drop. The shock system of boring is also used in connection with this plan. Some of the boring contrivances are of the order exhibited in Fig. 16. This type consists of a plain cylinder of the proper diameter for cutting the bore, about 4 feet long, with a tapering head or cutting end as shown.

Beds of sand are frequently met with in boring for gas that cannot be touched by the ordinary tool, and for which service the form of tool, shown in Fig. 17, of the scoop-end order, is utilized. The Chinese system of boring the earth to get the brine of salt water has been adopted in some of the localities where boring for gas is underway. This consists of a cutting tool adjusted inside a cylinder. The entire combination is lowered with the progress of the boring. The tool gathers the cut or loosened stuffs into the cylinder, and the latter is lifted up occasionally to empty; it is then dropped back for refilling. In the course of the day quite a depth is bored.

Incandescence and Luminosity.

The *Gas World* notes that M. Féry has published a voluminous series of details of an elaborate research into the amount of radiation from different substances at different temperatures, distinguishing between the calorific and the luminous values of these radiations and between the behavior of the different substances tested, when these are exposed to reducing and to oxidizing flames respectively.

Oxide of thorium and oxide of cerium behave very differently in different flames. In the reducing flame thoria gives a greenish white light, ceria a blood red at high temperatures and brick red at about 900° C.; in an oxidizing flame, thoria gives a rose-colored white, ceria a greenish blue. The radiation from ceria in a reducing flame is far higher than that from carbon and other "black bodies" at the same temperature, while that from thoria is less. Carbon and the interior of an electric furnace give only 0.05 candle per watt, while oxide of chromium gives three times as much light, both being at 1,400° C. Platinum and osmium give still more light, three to four times as much as carbon at the same temperature. Lanthania is very powerfully luminous, about 13 times as much so as carbon at the same temperature, but it soon fritters to pieces in the air, just as lime does, and it is of no use for mantles.

The Action of Thoria and Ceria.—Mantles of pure thoria give about 1-candle light, of pure ceria about 7, as compared with 70 from the Welsbach mixture of 99 thoria to 1 of ceria. A mantle of pure ceria, when exposed to a bunsen flame directed horizontally, gives a dark patch corresponding to the core of the flame, and this patch is surrounded by a bright ring, which from time to time runs in threads into the dark patch, with a crackling noise, and the incandescence reaches the center of the patch. This would indicate that there is something in the theory of condensation of gases in the ceria, which gases combine when the temperature is high enough (not a very high temperature in any case) and thus produce the temporary glow referred to. But the ceria has a much higher radiating power in a reducing than in an oxidizing flame (thoria and lime showing a contrary result), and this radiating power in a reducing flame is abnormal, being higher than that of theoretical perfectly black bodies brought to the same temperature. The temperature of the flame undergoes fluctuations; at the lower grades of temperature the ceria absorbs gases which are burned off at the higher, and this raises the local temperatures and therefore (since variations of luminosity are far more rapid than the variations in temperature which give rise to them) raises the local luminosities materially above that average which would have been due to a uniform temperature equal to the average local temperature of the flame. Apart from such fluctuations, ceria radiates like a black body, such as carbon; but thoria has such a poor radiating power until high temperatures are reached that the heat imparted to it goes directly towards raising its temperature, with very little incidental leakage by radiation. It therefore reaches very high temperatures without difficulty; and a Welsbach mantle reaches still higher, for here both causes come into play, the unwillingness of the thoria to part with its heat by radiation until high temperatures are reached, and the specific action of the small proportion of ceria in getting itself locally raised to still higher temperatures. The ceria radiates more than 10 times as much heat as thoria does, which both are at 1,200° C.; and this ratio rises as the temperatures rise. Ceria alone is therefore quite unsuited for making a mantle, as the heat imparted to it leaks away by radiation before high temperatures are at all reached. If the junction of a Le Chatelier pyrometer be coated with ceria, the ceria will lose so much heat by radiation that the readings of the pyrometer, in a flame, will stand some 200° C. lower than they should. The thoria is necessary as a carrier for the ceria, a carrier which is itself capable of acquiring high temperatures in a flame. The temperature acquired by a body plunged into a flame is higher the higher the temperature of the flame itself, the lower the radiating power of the body, and the greater the amount of the burning gases which came into contact with the body in the flame. The thoria which carries the ceria in the Welsbach mantle helps in this last respect by spreading the ceria out. If we wanted to make mantles of pure ceria we would have to make the filaments about $\frac{1}{1100}$ inch in thickness before we could get a satisfactory result.

The Eye Trained by the Sun.—If the percentage of ceria in the mixture is made to vary, we induce alterations in the part of the spectrum which presents the maximum amount of energy, and, correspondingly, we alter the luminous efficiency of the mixture. If we increase the percentage of ceria we increase the total amount of radiation, but the bulk of it is in the red, and the light is reddish; if we reduce the amount of ceria the radiation is less powerful, but bluish. There is a maximum lighting efficiency at a temperature which, for Welsbach mantles, is considerably higher than that of a gas or of an acetylene flame. The electric arc stands at about 3,900° C., and the proportion of its radiated energy which stands within the limits of the visible spectrum is about 19 per cent. of the whole. With the sun, whose temperature (as ascertained by M. Féry, with his pyrometric telescope) is about 7,800° C., the maximum of radiating activity stands within the visible spectrum, and it may well be that this apparent coincidence may really show that, in the course of development of the eye through geological ages, the eye has grown into a condition of special sensitiveness to those particular kinds of radiation of which the sun itself sends us most.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE new plant recently constructed for the "municipality" of Fredericksburg, Va., under the direction of Mr. Frederic Egner, will be in actual working operation this week.

THE Cruse-Kemper Company, of Philadelphia, has been awarded a contract by the Elizabethtown (N. J.) Gas Light Company for the construction at Elizabeth, N. J., of a triple-lift holder, to rest in steel tank. The capacity of the holder is estimated at 1,000,000 cubic feet. President Cruse says (and his word usually goes) that the holder will be completed according to the specifications, and at the time promised.

"W. F. F.," writing from Montreal, Canada, under date of the 9th inst., says: "If you can consistently so mention, I would like to use the item column by stating therein that final proceedings have been entered to wind up the affairs of the old gas and electric light companies of Woodstock, Canada. Some years ago the Woodstock Gas Company purchased the plant and franchises of the Woodstock Electric Light Company and later on both plants were purchased for operation on public account by the municipality, but there never was an accounting as a finality to the John Patrick estate. This may seem a trifling thing to mention, but the publication thereof might eventually save some gas investors in Canada from making purchases of doubtful value."

THE proprietors of the El Reno (O. T.) Gas Company have purchased the rights and properties of the local electric lighting concern.

MR. J. B. MYERS has been appointed to a responsible position with the Connecticut Railway and Lighting Company in its Waterbury branch.

THE certification of an increase in the capital stock of the Union Gas and Electric Company, of Bloomington, Ills., from $450,000 to $750,000, has been filed.

On the 10th inst. the Board of Gas and Electric Light Commissioners took testimony on the petition of the Amherst Gas Company to partially supply the adjoining district of Pelham with electric currents for light and power purposes. There was no opposition.

The annual meeting of the Woonsocket (R. I.) Gas Company, which was to have been held last month, was set over to the last Tuesday of this month.

"B. W. H.," writing from Bellingham, Wash., under date of the 4th inst., incloses the following: "To-day the Whatcom County Railway and Light Company announced a reduction of 10 per cent. in the selling rates. Gas on fuel account which formerly ruled at $1.75 per 1,000 is now $1.58, and gas for illumination—old rate $2—is now $1.80. Coal and wood are scarce, therefore dear, in Whatcom. The Company has expended about $75,000 in extensions and betterments of all sorts this year, and Manager Bean is now knowing the fact that gas is a pretty good thing to deal in. Messrs. Stone & Webster found that fact out some time ago.

This is from a recent issue of the Burlington (Ia.) *Hawkeye:* "While electricity is said to be the light of the future, and while the electric light seems the most satisfactory in many respects, there is a constant and ever increasing demand in Burlington for gas for fuel and light; and in order to meet a portion of this demand the Peoples Gas and Electric Company has taken steps to enlarge its plant. The present capacity of the works is 120,000 cubic feet per day, and Manager Walsh says its future capacity will be 250,000 cubic feet."

The latest applicant for a franchise to supply gas in Las Vegas, New Mexico, is Mr. W. G. Colburn, of Colorado Springs, Col. He promises, in consideration of a 50-year grant, to furnish gas for all uses at $1 per 1,000 cubic feet.

Mr. William J. Morrison, who is now in control of the St. Charles Company, declares that he is sure there is more money in gas than there is in electricity. No doubt of it; we thought so even in the foreboding days of 1878.

The Boston *Post* of the 9th inst., says that work has been started on the new pipe line to connect the plant of the Waltham Gas Light Company with the mains of the Boston Consolidated Company. The main crosses Pine street and runs through Gardner street to Taylor. It will be continued through Oak, Cedar and Calvary streets to Farwell, where it will connect with the line in Newton. A 20-inch pipe is being laid and when the line is completed the local Company will receive its supply of gas from the Boston Consolidated Gas Company under a contract approved by the State Commissioners. Under the contract the Waltham Company can purchase gas cheaper than it can be manufactured here. It will be at least 2 months before the new pipe line will be completed.

The special election for voting on the proposition to or not grant a franchise to the promoters of the Mount Ayr (Ia.) Gas Company will be held to-day. Local advices are to the effect that all the sentiment is in favor of a majority for the gas plan.

According to the Elgin (Ills.) *News* of November 7th, a deed for 22 acres of land in Joliet, Ills., marks another step in the consummation of a huge gas project. The deed runs from H. H. Stoddard, of Chicago, to the Western United Gas and Electric Company, and is for land north of the city of Joliet on the western bank of the drainage canal. Over $1,000,000 will be expended by the Company in the erection of its plant on the 36 acres which it now owns in that section of the country. When all is finished the plant will become the distributing point for all of the gas in the big circuit of cities whose supply is controlled by the Western United Company. In due time the plants in all the other cities will be closed down and Joliet will be the gas center of the northeastern part of the State. The capacity of the retort houses in Joliet is to be more than quadrupled and a gasholder with a capacity of 2,000,000 feet will be constructed. The arrangements for coal and coke storage are to be greatly enlarged, as Joliet will have to become the distributing point for the coke industry of this section. Much heavy and costly machinery is to be installed for the manipulation of coal and coke in gas production and for the handling of by-products, such as tar and ammonia. The buildings are to be of iron and stone construction. Each will be built separately. Included in the purchase by the Company are the grounds and buildings occupied by the Illinois Match Company, but the latter concern will continue without interruption. The work will be finished in 1906.

An explosion that occurred in the smithing shop of the Springfield (Ills.) Gas Light Company some days ago caused damage amounting to $500. Manager Schmidt sorrows more over the loss of a carload of gas stoves than any other asset, for gas stoves are, despite the lateness of the season, still being sold in Springfield.

The City Council of North Adams, Mass., has decided against the proposition to engage the city in the operation of gas and electric lighting plants.

Mr. H. Bruce, who certainly is an expert in the gas business, has reported that Mr. W. P. Knowles, Superintendent of the Richmond (Va.) City Gas Works, is not an expert in the sense that he favors municipal ownership. Mr. Bruce's friends believe that the Richmond works would do better were they in their hands.

The Dauphin County (Pa.) Gas Company has about completed the extension of its main system.

Mr. Charles H. Nutting, Superintendent of the Chicopee (Mass.) Gas Light Company, has been elected County Commissioner for Hampden county, Mass. Springfield's gas men are to be congratulated on his election.

Mr. C. V. Newman, who has been in charge of the affairs of the Greencastle (Ind.) Gas, Electric Light and Power Company for something over 2 years, says that there is no such thing in Greencastle as poor gas.

The General Gas Light Company of Kalamazoo, Mich., reports "the light that's right," is doing quite well.

Mr. J. Ira Tritt, of Philadelphia, has been elected Secretary and Treasurer of the Carlisle (Pa.) Gas and Water Company, vice the late Mr. John B. Landis.

It is confirmed that Messrs. Carroll Collins, A. C. Frost and Gordon Ramsey have purchased the Marshall (Mich.) Gas Company.

On and from the 1st prox. the low net selling rate at New Haven is to rule at 95 cents per 1,000.

"F. J. P." sends the following from Milwaukee, Wis., under date of the 9th inst.: "About 50 members of the Milwaukee Press Club spent several hours last Monday as guests of the Milwaukee Gas Light Company. Shortly before 4 o'clock the party left the Club in a private car and arriving at 25th and Clybourn streets the members ascended about 40 of the 210 feet of height of the new gasholder, which is a large one, and is second only to the one in London. Here the visitors paused to watch Col. E. G. Pratt, General Manager of the Company, drive the last rivet, which was of silver. Then a picture was taken of the party. Following this the party was shown through every department of the huge plant and instructive information was given by the heads of the various departments who acted as guides. In the meter room a banquet was served. Col. E. G. Pratt welcomed the guests, and President M. C. Douglas of the Club responded. Others who spoke were Col. 'Dan' B. Starkey, Thomas Boggs, Mark Forrest, Wilmer Sieg, S. Y. Gillan, Alonzo Burt, John Gregory, Ewald Haase and R. B. Brown. Stephen Aldridge, who began work with the Company in 1860, and was recently pensioned, was present. He is the oldest employee of the Gas Company and was heartily applauded by the visitors when he arose to correct Col. Pratt saying that he had worked 3 less years for the Company than the Manager had given him credit for."

The Navy Department, Washington, D. C., through the Bureau of Supplies and Accounts, is inviting sealed proposals until November 28, for furnishing Eastern navy yards with the following electrical supplies: Schedule 224, arc lamps, wire conduit, panel boards, electric clock, electrical supplies; schedule 225, micanite; schedule 227, motor, electrically driven grinders and drills. Blank proposals and full information can be obtained at the Navy Pay Office in New York or upon application to the Bureau in this city. On December 12th the Bureau will open bids for furnishing Western navy yards with the following: Schedule 230, arc lamps, electrical supplies; schedule 231, storage battery outfit, generating set, transformer; schedule 233, motor. Blank proposals can be obtained upon application to the Bureau in this city.

THE AMERICAN GAS LIGHT JOURNAL

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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

MONDAY, NOVEMBER 20, 1905.

The Market for Gas Securities.

There is very little to say regarding the condition and values of prices of city gas shares. It looks, however, as it was suggested in these columns some months ago, that the State Commission of Gas and Electricity is not an unmixed evil. Consolidated Gas is bid for 179¼ to 180 ex. Brooklyn Union is 180 bid, and we think it will be bid higher in short time. The Brooklyn Union Company's regular dividend of 2 per cent. for the past quarter is payable December 1st.

Peoples, of Chicago, is 102¼ bid; and Washington is 296 to 300. The latter should be 320 asked. Lacledes hold well.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks,
16 WALL STREET, NEW YORK CITY.
NOVEMBER 20.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

New York City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$75,177,000	100	179¼	180
Central Union, Bonds, 5's	3,000,000	1,000	108	110
Equitable Bonds, 6's	1,000,000	1,000	..	105
" 1st Con. 5's	2,300,000	1 000	118	120
Mutual	3,500,000	100	275	290
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co.. Bonds, 5's	11,000,000	1,000	111	114
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	98	104
Northern Union, Bonds, 5's	1,250,000	1,000	105	107
New York and East River.. Bonds 1st 5's	3,500,000	1,000	112	114
" 1st Con. 5's	1,500,000	..	106½	108½
Standard	5,000,000	100	140	160
Preferred	5,000,000	100	155	175
Bonds, 1st Mortgage, 5's	1,500,000	1,000	111	114
Yonkers	299.650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	180	190
" " Bonds (5's)	15 000,000	1,000	113	115
Bay State	50,000,000	50	3/16	¼
" ncome Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	509,000	1,000	95	100
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000.000	1.000	47½	50
Buffalo City Gas Co.	5,500,000	100	10	12
" Bonds, 5's	5,250,000	1,000	75	80
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas and Electric Co	29,500,000	100	103	103½
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	90	..
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	..	95
Preferred	3,026,500	100	107½	103
Consumers, Toronto	,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	86	..
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	..	50
" Prior Lien 5's	5,603,000	1,000	..	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000		101
Essex and Hudson Gas Co.	6,500,000	..	39	40
For Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,325,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	110	112
" Bonds, 5's	10,500,000	..	110	110½
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104½	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	86
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100		
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	108½	109
Lafayette Gas Co., Ind	1,000,000	100	..	60
Bonds	1 000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	102½	102¾
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104½	1 5¼
San Francisco, Cal	15,800,000	100	58½	58¾
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	96¼	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,600,000	20	295½	300½
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del	600.000	50	280	..

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(*Continued on page* 849.)

DIVIDEND NOTICE.

OFFICE OF THE AMERICAN GAS COMPANY,
222 S. THIRD ST., Philadelphia, Pa., Nov 15, 1905.

The Board of Directors of The American Gas Company has this day declared a semi-annual dividend of 3 per cent., or $3 per share, on the capital stock of the Company, payable on and after Dec. 1, 1905. Checks will be mailed.

1589-1 WALTER GODLEY, Treasurer.

NOTICE!

At the American Gas Light Association's last meeting one of the exhibits that interested the meter men was the improved meter and prepayment device exhibited by **The New York Improved Meter Co.** See our advertisement.

1587-tf

NOTICE!

PLEASE read the advertisement of the Empire Gas Improvement and Construction Company, on page 857 This Company employs only high-priced and quick-working mechanics, and all its work is guaranteed to be strictly first class, and will be finished at time specified.

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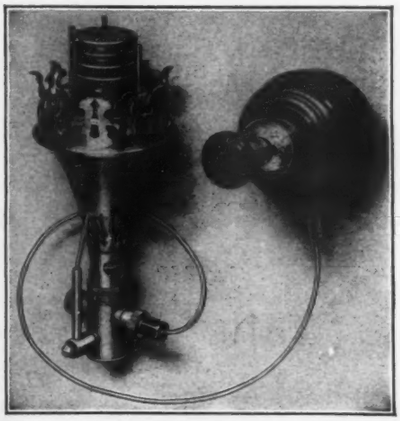

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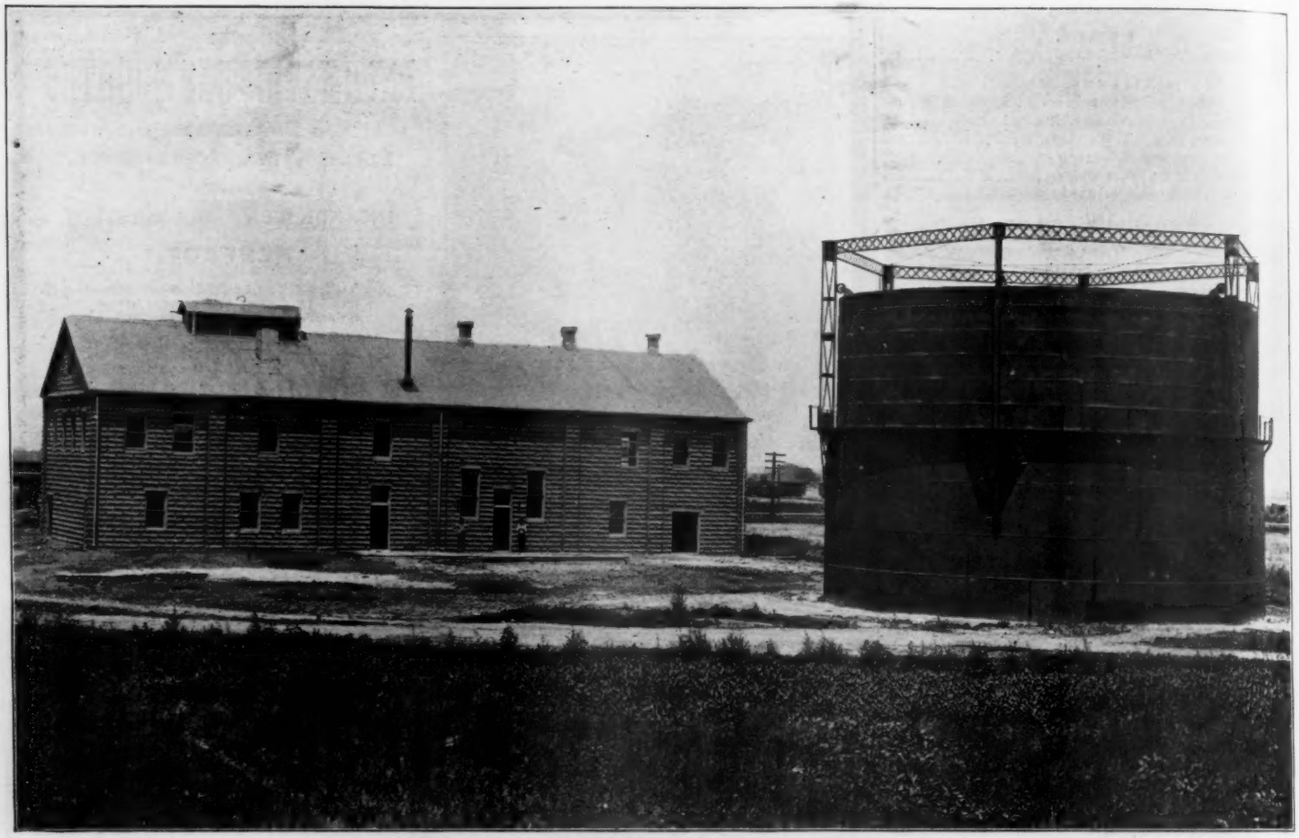

The illustration shows the main external details of the Coal Gas Plant of 250,000 daily capacity, constructed by Mr. FRANK D. MOSES, of Trenton, N. J., at Granite City, Ills., for the Granite City Gas Light and Fuel Company.

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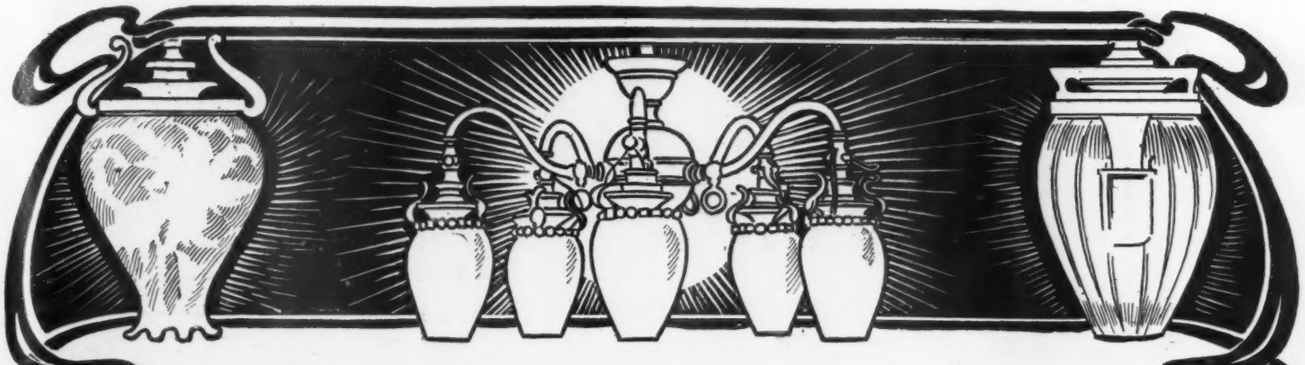

THE IMPORTANCE TO GAS MANUFACTURERS

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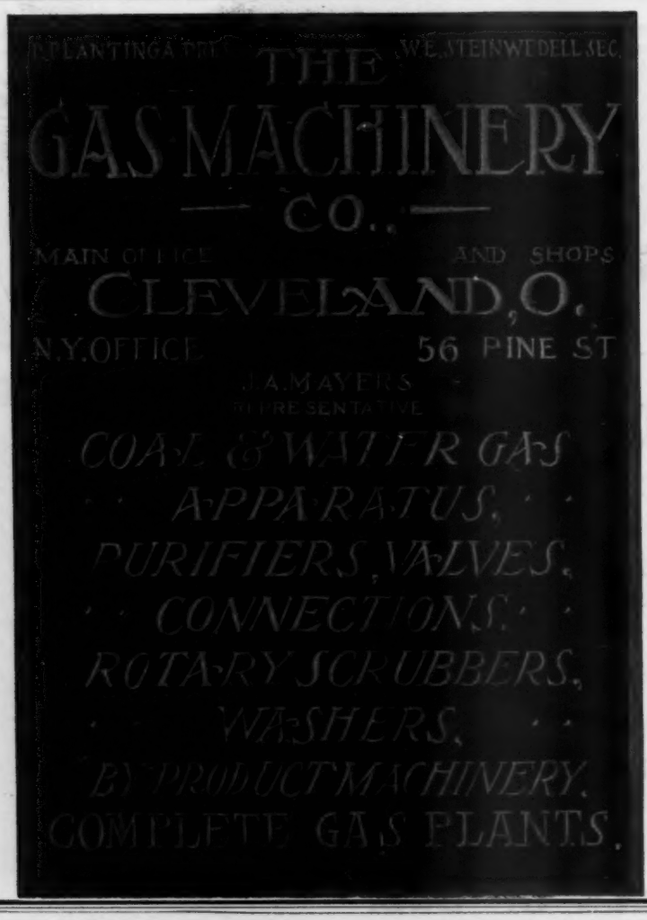

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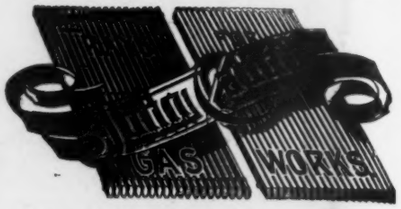

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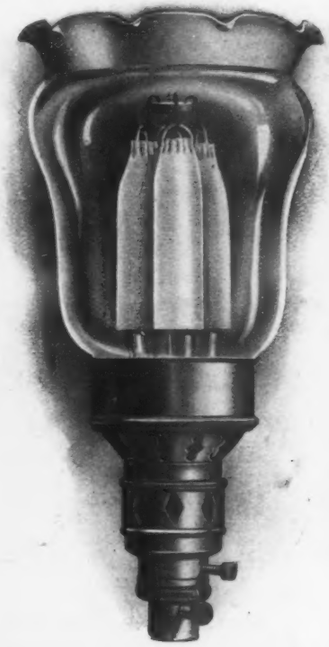

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A WORD TO THE GAS PRODUCER.

EVERY producer wants his goods to show at their best.

Every gas producer wants his gas to give the best possible light—therefore he endeavors to produce the best possible gas.

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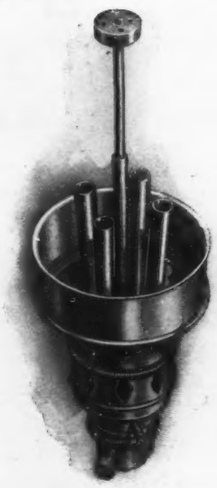
are used exclusively by over 300 gas companies in the U. S. If you are not one of them and are having any trouble with the arcs you are using, we guarantee to stop that trouble with the use of the Doorenbos. It won't cost you anything to give this a trial. Put the responsibility on us. Write to-day for our plan.



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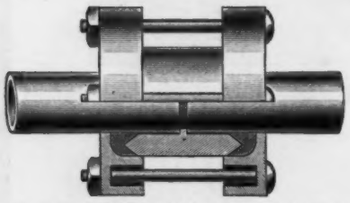
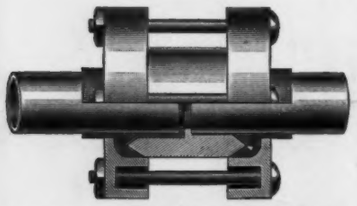
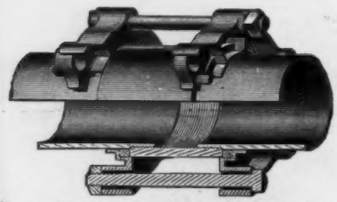


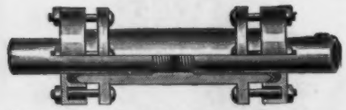
Regular Coupling, Style 1, for Plain End Wrought Iron Pipe.



Insulating Coupling, Style 5, for Plain End Wrought Iron Pipe,



Clamp, Style 4, for Repairing Leaks on Screw Collar.



Long Sleeve, Style 2, for Mending Broken Lines.

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Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

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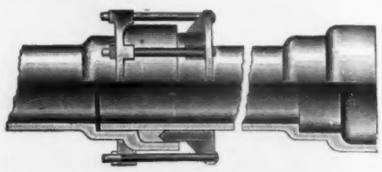
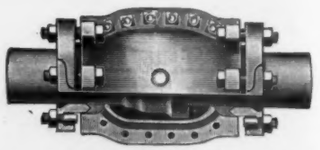
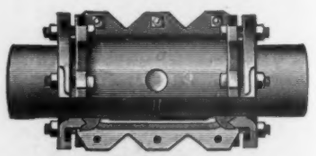


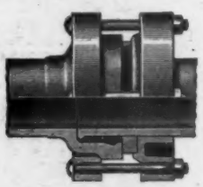
Coupling, Style 9, for Special Style Cast Iron Pipe.



Split Sleeve for Repairing Broken Bell on Cast Iron Pipe.



Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.



Clamp, Style 4½, for Repairing Leaky Lead or Cement Joints in Cast Iron Pipe.

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For the convenience of Eastern gas companies and dealers we now have a full stock of Steward Burners and Lava Gas Tips in New York city. Your orders will be filled promptly.

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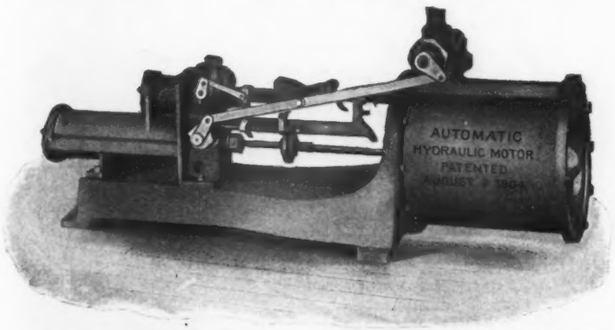

will more than double the candle power of the ordinary mantle light. Get particulars. Leased to consumers through gas companies only. An interesting and liberal proposition will be submitted to gas companies for the asking.

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For Structural Iron and Steel, Gas Apparatus, Underground Piping, Boiler Fronts, Stacks, etc.

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Heat with the whole of it.

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Cook with the half of it.

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The coldest air lies next to the floor always. The Humphrey Oval (see illustration) takes the cold air from the floor, heats it hot and forces it out at the side. Other stoves allow this heat to rise directly to the ceiling without being diffused through the room, thus taking a long time to heat the room, wasting time and fuel.

Height, 16 inches. Weight, 4¼ pounds

Price, polished nickel, per dozen,... $24

Not sold in less than dozen lots.

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Why not send us an order to-day for your season's requirements?

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Divides in the middle. No nuts, bolts or screws.

When not in use, or to pack, pull the legs out, untwist the burner and pull it out, tuck one-half of the jacket inside the other and lay the legs and burner in the bowl. A child can do it, and, when done, it occupies a very small space.

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Nickel Cylinder Lamps,

Used either with or without shades. Supplied with round or pear globes. :: ::

Just the lamp to offer the hesitating consumer who wants a different design.

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AND HIGH PRESSURE GAS PUMPS BUILT BY

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THE ANSWER IS IN THREE WORDS:

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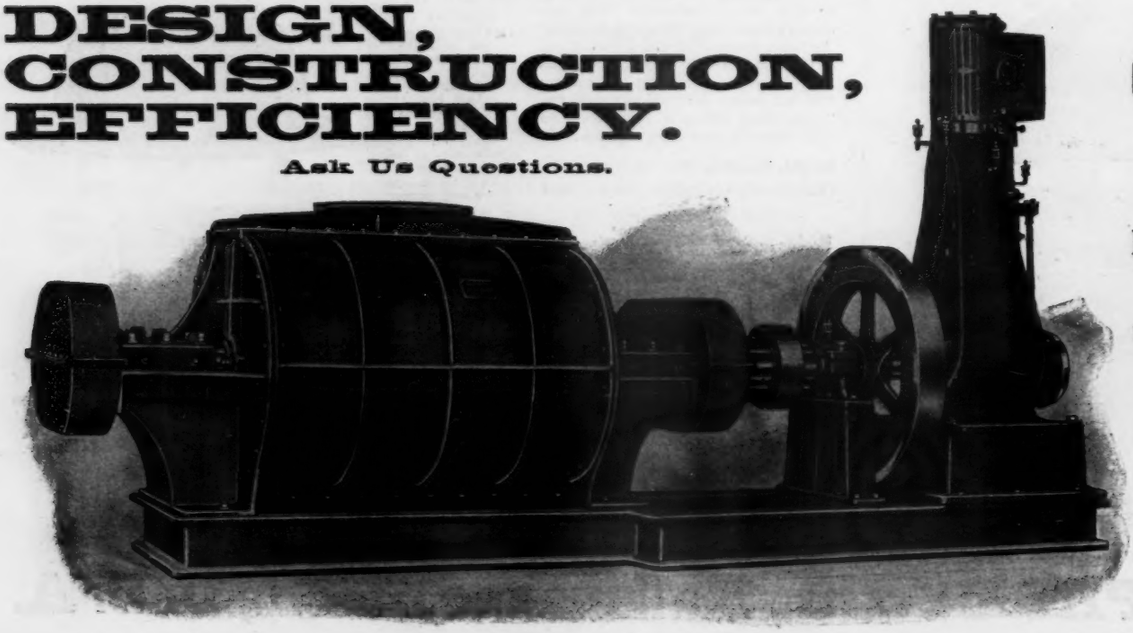

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Double and Single Gate Valves, ¼" to 72"

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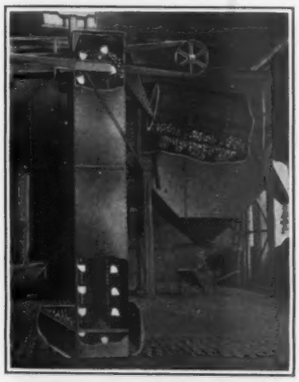

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Reclaim Coke from Ashes.

Mutual Gas Light Co., New York City.

Write to us for full description of this and other Link-Belt machinery successfully applied to gas house use.

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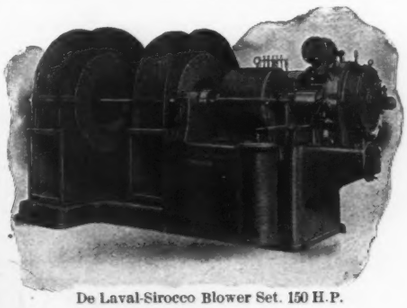

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Steam Turbine Motors
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THE HUNT STEAM SHOVEL.
Greatest filling power of any other style of shovel.
Stock sizes: ½, 1 and 2-ton capacity.

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With Instructions for Care and Working of the Same,

By G. LIECKFELD, C.E.
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Gas Engineer's Pocket-book, —BY— HENRY O'CONNOR,
Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works. PRICE, $3.50. For Sale by
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This Company has purchased the patents and goodwill in the business hitherto carried on and owned by *A. M. Sutherland.* It is now ready to contract for the erection and installation of

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The high character of the work done by A. M. Sutherland during the past 15 years will be strictly adhered to and all work is warranted.

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IMMERSION WASHERS.

A design embodying particularly desirable features.

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SPECIAL GRADE SERVICE COCK.

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Some gas cocks may truthfully have the claim made that they will retain gas, but the fact can't be practically demonstrated on account of their going to pieces at the hands of the fitter.

Mueller Gas Cocks are carefully ground to insure their being gas-tight, and strength to stand rough use at the fitter's hands is assured in the excellence of the metal and extra thickness at places that are subjected to strain in fitting in. They are prepared to practically demonstrate all claims made for them.

Mueller Gas Cocks are made in straight, oval and round way patterns. Straight way cocks are made in standard, extra and special grades, the oval way cocks in the extra grade only, and the round way cocks in the standard and extra grades. The cock illustrated is the special grade straight way cock.

Each cock is carefully inspected and assure test, bears the Mueller trade mark, and sembled, is given a 75-pound hydraulic pressure *unconditionally guaranteed.*

We also make tapping machines and meter connections for gas works' use. Catalogues upon application.

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Installation showing our latest improved machines, with flexible rope coupling, for large units.

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For Gas, Water and Electric Light Companies, at
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THE SEVENTH EDITION, ILLUSTRATED,
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This Edition of the "Handbook for Gas Engineers and Managers" is a great improvement on all previous editions. Much of the text has been re-written, in order to keep the work abreast of the constant advances that are being made in the Gas Industry.

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MANUFACTURERS OF

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FOR WATER AND GAS.

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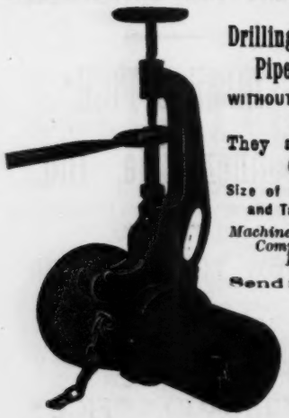

Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

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Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

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MUELLER GAS MAIN TAPPING MACHINE.

The Mueller "Swivel No. 1," "Swivel No. 2" and "Swivel No. 3" Tapping Machines are made especially for tapping gas mains under pressure. They are made extra heavy in all parts, have extra long ratchet sweep and can be adjusted to any angle or corner of the ditch. The No. 1 taps up to 2-inch, the No. 2 up to 3-inch and the No. 3 up to 4-inch. The "Century" makes taps from ¼ to 1 inch in high pressure mains. Unconditionally guaranteed. Catalogues upon application.

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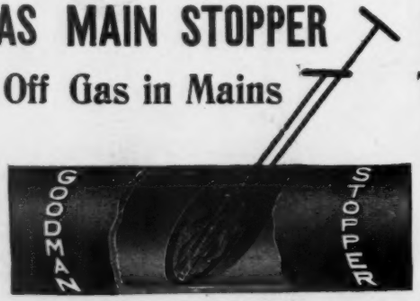
For Shutting Off Gas in Mains

Any size gas main can be shut off in 30 seconds. : : :



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WE began the manufacture of Economizers in 1845, and since then, from our experience in applying the Economizers to over 300,000 boilers, we have steadily improved and simplified their construction. Such complications as internal pipes, revolving economizers, elbows, wrought iron tubes, etc., have all been tried and discarded.

We first began building Economizers with staggered pipes about the year 1852, but found that usually they interfered so much with the chimney draft that we had to discard that method. In the last 10 years, or since mechanical draft has become a practical success in some cases, we have been prepared to put in staggered pipes when our customers asked for them, explaining that on account of the increased friction of gases passing through the economizer the power required to drive the mechanical draft fan was much greater.

Send for our BOOK "AG." giving information for designers of power plants, and ask also for our new Catalog of Fans, Blowers and Exhausters.

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Ninety-three Illustrations and Nine Folding Plates. Bound in Handsome Half Leather. Price, $6.50.
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GAS MANUFACTURE,
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NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

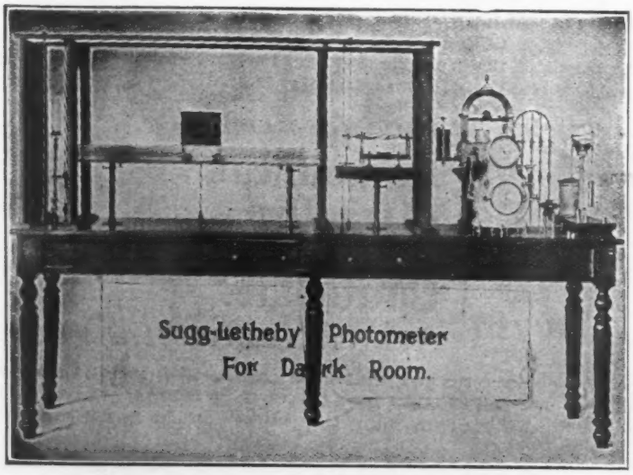
DECEMBER, 1905.

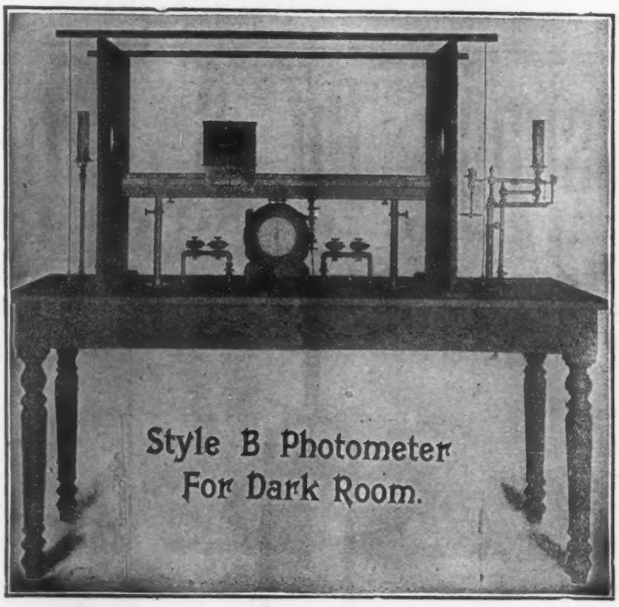
Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.
Fri.	1	9.00 PM	6.00 AM
Sat.	2	10.00	6.00
Sun.	3	11.00 FQ	6.10
Mon.	4	12 00	6.10
Tue.	5	12.50 AM	6.10
Wed.	6	1.50	6.10
Thu.	7	2.40	6.10
Fri.	8	3.40	6.10
Sat.	9	4.40	6.10
Sun	10	No L.	No L.
Mon.	11	No L. FM	No L.
Tue.	12	No L.	No L.
Wed.	13	5.00 PM	7.20 PM
Thu.	14	5.00	8.20
Fri.	15	5.00	9.20
Sat.	16	5.00	10.20
Sun.	17	5.10	11.20
Mon.	18	5.10	12.30 AM
Tue.	19	5.10 LQ	1.40
Wed.	20	5.10	2.50
Thu.	21	5.10	4.00
Fri.	22	5.10	6.20
Sat.	23	5.10	6.20
Sun.	24	5.10	6.20
Mon.	25	5.10 NM	6.20
Tue.	26	5.10	6.20
Wed.	27	5.10	6.20
Thu.	28	5.10	6.20
Fri.	29	5.10	6.20
Sat.	30	8.40	6.20
Sun.	31	9.40	6.20

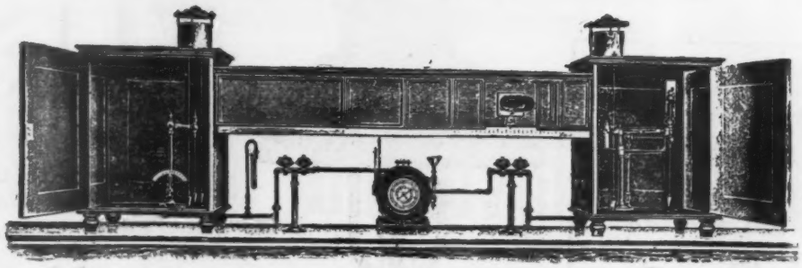
TOTAL HOURS DURING 1905.

By Table No. 1.

	Hrs.Min.
January	240.50
February	192.20
March	207.00
April	175.10
May	161.00
June	139.50
July	149.00
August	161.50
September	173.00
October	205.00
November	211.00
December	229.00
Total, yr.	2245.00







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

DECEMBER, 1905.

Day of Week.	Date.	Table No. 2. NEW YORK CITY. All Night Lighting. Light.	Extinguish.
		P. M.	A.M.
Fri.	1	4.20	6.10
Sat.	2	4.20	6.10
Sun.	3	4.20	6.15
Mon.	4	4.20	6.15
Tue.	5	4.20	6.15
Wed.	6	4.20	6.15
Thu.	7	4.20	6.15
Fri.	8	4.20	6.15
Sat.	9	4.20	6.15
Sun.	10	4.20	6.20
Mon.	11	4.20	6.20
Tue.	12	4.20	6.20
Wed.	13	4.20	6.20
Thu.	14	4.20	6.20
Fri.	15	4.20	6.20
Sat.	16	4.20	6.20
Sun.	17	4.20	6.20
Mon.	18	4.20	6.20
Tue.	19	4.20	6.20
Wed.	20	4.20	6.20
Thu.	21	4.20	6.20
Fri.	22	4.20	6.20
Sat.	23	4.20	6.20
Sun.	24	4.20	6.25
Mon.	25	4.20	6.25
Tue.	26	4.20	6.25
Wed.	27	4.20	6.25
Thu.	28	4.20	6.25
Fri.	29	4.20	6.25
Sat.	30	4.20	6.25
Sun.	31	4.20	6.25

TOTAL HOURS DURING 1905.

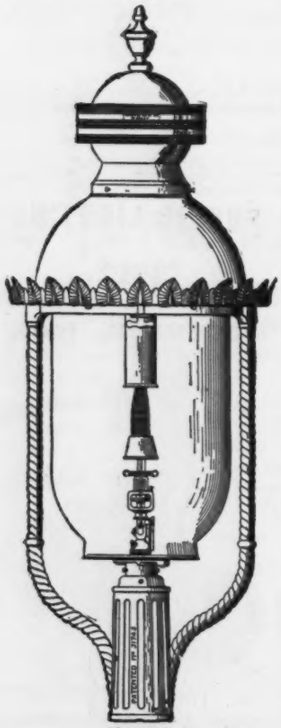
By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 97 Liberty Street. BOSTON, 814 Beacon Building. PHILADELPHIA, Bread and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, Foot of Orleans Street. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 30.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others Interested in Municipal and Outside Lighting.

No. 38.

The Welsbach No. 6 Harp Fixture.

AN IDEAL LIGHT FOR DINING OR LIVING ROOMS.

THE HIGHEST MECHANICAL INGENUITY COMBINED WITH ORNAMENTAL BEAUTY--THE NEWEST OUTPUT FROM THE WELSBACH FACTORIES.

Equipped with new model No. 66 high candle power Welsbach Burner.

Side Pilot By-pass Tube covered with refractory sleeve to prevent bending.

Fourteen-inch Opal Dome Shade.

Polished Brass Embossed Crown 2¼ inches high.

Length of Fixture, 30 inches.

Width of Harp, 4½ inches.

Finished in Polished Brass.

Packed One Dozen to the Case.

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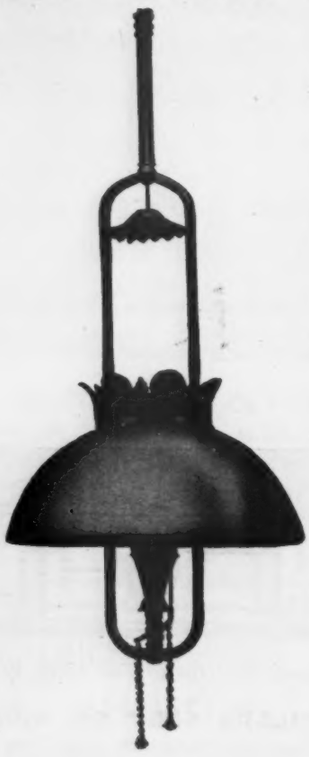

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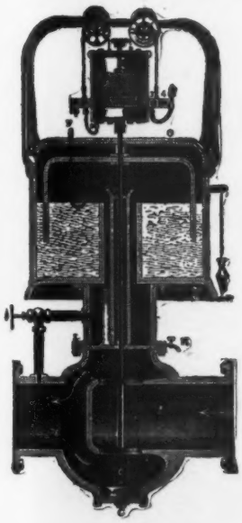

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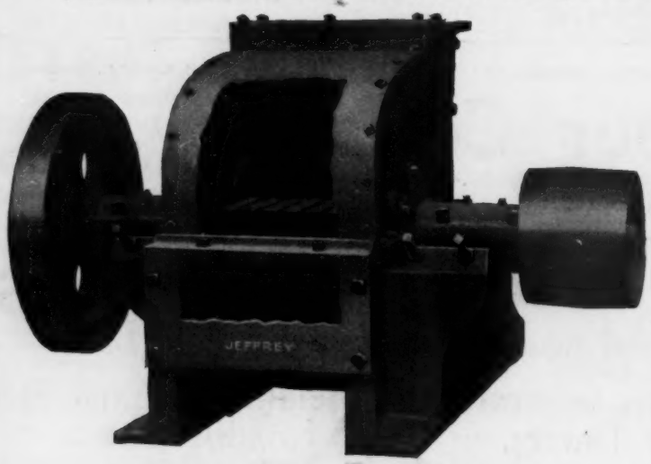

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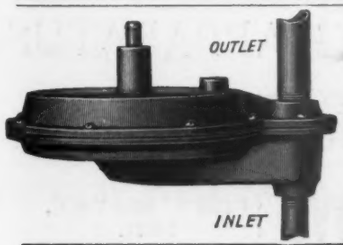

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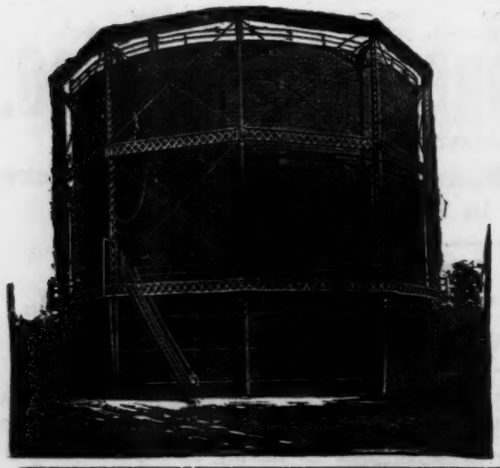

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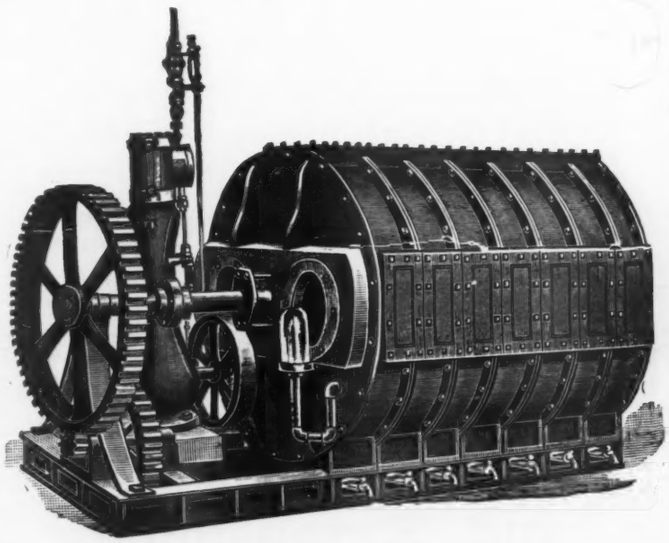

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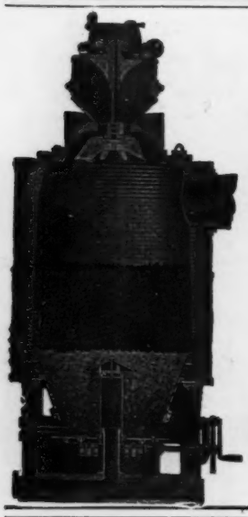

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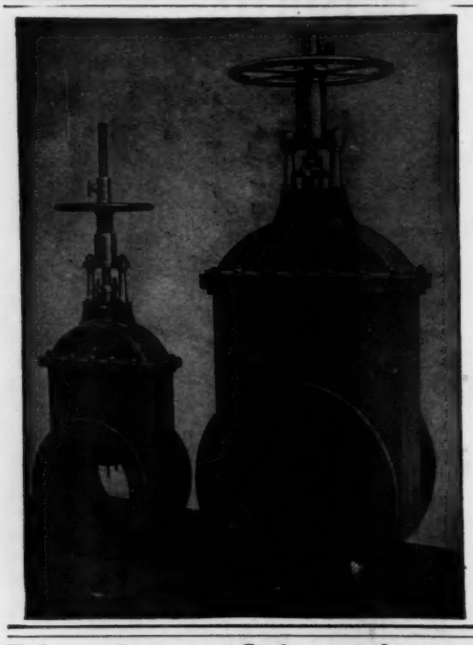

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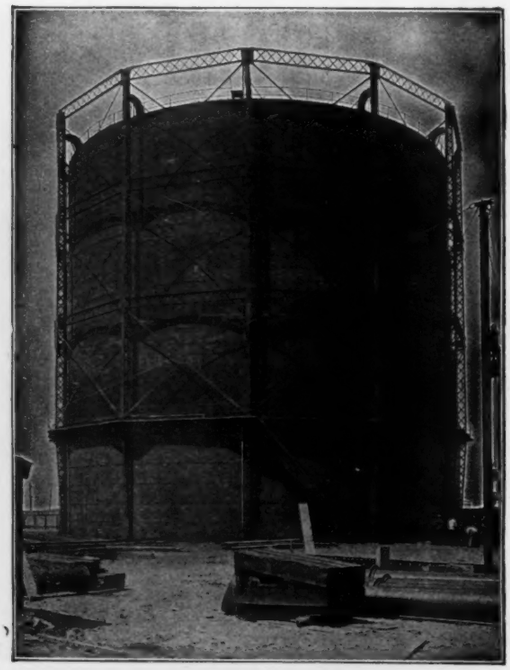

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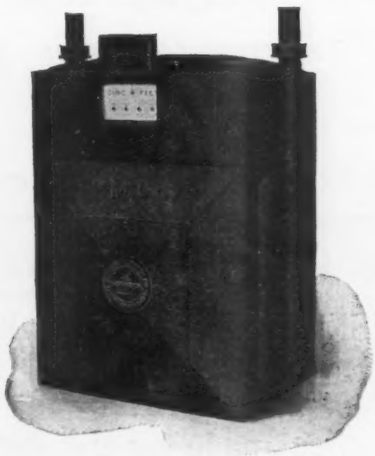

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—OF THE—

BOARD OF GAS COMMISSIONERS of the COMMONWEALTH OF MASSACHUSETTS.

MR. E. H. YORKE, NEW HAVEN, CONN., Dec. 1, 1898.

Dear Sir: I am in receipt of a copy of "Excerpts from the Decisions of the Board of Gas Commissioners," which is a handy compilation in book form of extracts from the most recent decisions of the Gas Commission of Massachusetts.

I note that most of these extracts are broad and safe-guiding precepts, which apply with equal force to one Company as to another. The 13 years' existence of the Board of Gas Commissioners, with its unusual opportunities for acquiring information, have justly made it a high and safe authority in all matters pertaining to the management, obligations and rights of Gas Companies. Your little book will serve as a valuable reference library in settling legal complications which often arise between a Gas Company and its customers.

Yours truly, (Signed) F. C. SHERMAN, Superintendent.

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BEFORE.

This is a photograph of a 3-light regular meter out of a lot of meters received from the Coatesville Gas Co., Coatesville, Pa., to be repaired and converted into prepayment meters.

AFTER.

This is the same meter after it has been repaired and converted into a new prepayment meter.

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